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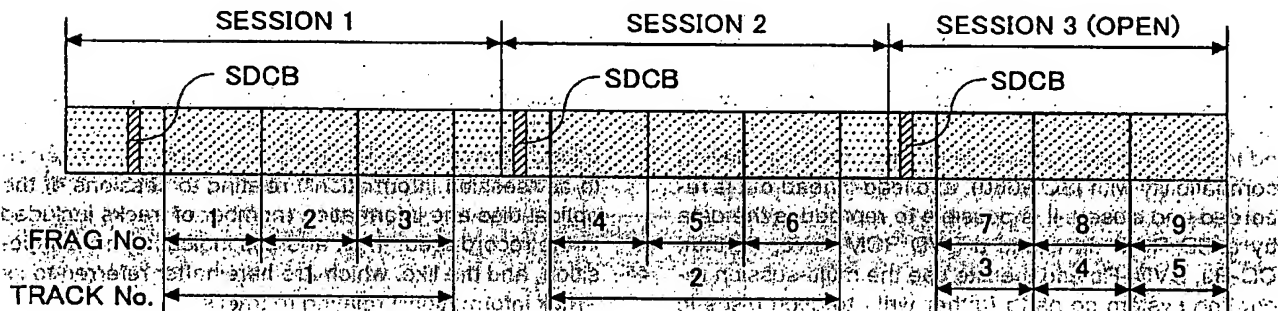(54) **Information reproducing apparatus, data management information obtaining method, data management information obtaining program, and storage medium**

(57) An information reproducing apparatus reproducing information of an information recording medium is disclosed. In the information recording medium, a record area is divided into a plurality of data areas. Also, data are recorded for each of the divided data areas. In addition, management information relating to the data recording is recorded in a predetermined management information area. Further, the management information is updated and recorded in a new management information area every time a predetermined data recording is completed. A receiving part receives, from an external device, an obtaining request for the management information. The obtaining request includes designation of a specific management information area. A management information obtaining part obtains the management information relating to the data recording from the specific management information area designated in the received obtaining request. A reporting part reports, to the external device, the management information relating to the data recording obtained from the designated specific management information area.

FIG.2

EP 1 329 893 A2

INSDOCID: <EP_____1329893A2_I_>

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention generally relates to information reproducing apparatuses, data management information obtaining methods, data management information obtaining programs, and storage media that reproduce data requested by users from recordable information recording media such as DVD+Rs.

2. Description of the Related Art

[0002] Recently, with the improvement of their functions, personal computers (PCs) have been able to handle AV (Audio-Visual) information such as music and images. Since the amount of the AV information is very huge, optical discs such as CD-R (Compact Disc-Recordable) and DVD+R (Digital Versatile Disc+Recordable) have been attracting attention as information recording media. As the prices of the optical discs have been reduced, optical disc devices as information reproducing apparatuses have become widely used as one of the peripheral devices of the PCs.

[0003] There is the Universal Disc Format (UDF) standard as a file system using recordable information recording media such as CD-Rs and DVD+Rs. The UDF is the file system used for various devices and utilizing a record format that takes advantage of a characteristic of each device. Especially, CD-Rs and DVD+Rs apply the sequential UDF In which data are sequentially recorded from the inner side of a disc, since CD-Rs and DVD+Rs are write-once types that do not allow overwriting of data.

[0004] Generally, in the sequential UDF, in order to maintain the compatibility with ISO 9660, the first track is reserved and data requested from a user are incrementally written from the second track. That is, the multi-track recording system that records data by dividing a session into a plurality of tracks, which form recording units, is used.

[0005] In the above-described recording state in the sequential UDF, since an unrecorded area exists in a session, reproduction is possible only by an information recording/reproducing apparatus, and it is impossible to reproduce using an information reproducing apparatus such as a CD-ROM drive or a DVD-ROM drive. However, when file system information of record data is recorded to the first track (record file information for achieving compatibility with ISO 9660), and lead-in/lead-out is recorded and closed, it is possible to reproduce the data by a CD-ROM drive and a DVD-ROM drive. Further, CD-Rs, DVD+Rs and the like use the multi-session recording system so as to further write to such discs in which sessions are closed.

[0006] In the CD-R, the maximum track number is limited to 99 tracks, which is a small number. Thus, irrespective of the number of sessions, information of the tracks existing all over the disc is recorded in an area called program memory area (PMA). Accordingly, it is possible to manage the information of all the tracks. Hence, in a CD-R, it is possible to immediately report the information of a track requested by the user by storing, in the memory of a drive unit, the track information obtained from the PMA.

[0007] On the other hand, the DVD+R allows recording of up to 191 sessions in the record area. Each of the sessions allows recording of up to 16 tracks (referred to "fragments" in the DVD+R). That is, up to 3056 (= 191 x 16) fragments, which is a vast number, can exist on a DVD+R. Additionally, in the DVD+R, a lead-in of the second session (and later sessions) is called an "intro", and a lead-out before the last session is called a "closure". Information (fragment number, start address of fragment, last address of fragment and the like, which are hereinafter referred to as "fragment information") relating to fragments in each session is recorded in a management information area called session disc control block (SDCB) that is recorded in the lead-in (or the intro) of the session. The SDCB includes information (session number, start address of session, last address of session and the like) relating to all sessions before the session as well as all fragment information of the session.

[0008] That is, in the DVD disc such as a DVD+R and DVD+RW, disc control blocks (DCBs) indicating the record state of the disc exist, and a means for reporting DCB information to the user is prepared. In the DVD+R, as mentioned above, there are the DCBs such as the SDCBs that include information of all sessions existing on the disc and information of all fragments existing in the session. In addition, in the DVD+RW, there is a formatting disc control block (FDCB) having information of the format state and the like. Since it is possible to overwrite the DVD+RW, when the format state is changed, the FDCB is overwritten and updated. On the other hand, since the DVD+R is a write-once disc that cannot be overwritten, the SDCB is updated and recorded in a predetermined new SDCB area every time a session or a fragment is added.

[0009] By the way, there is a case where an upper device (for example, a PC) using such an optical disc device requires, prior to reproducing an optical disc, management information relating to data recorded on the optical disc. Thus, the upper device is configured to be able to request, from the optical disc device, the management information (number of sessions included in the record area and the like, which are hereinafter referred to as "session information") relating to sessions of the optical disc and information (number of tracks included in the record area, track address indicating a track position, and the like, which are hereinafter referred to as "track information") relating to tracks.

[0010] Corresponding to this, when the optical disc is a DVD+R, for example, the optical disc device reports

the above-described fragment information to the upper device in response to a request for the track information from the upper device. Also, when the optical disc is a CD-R, the optical disc device obtains the answer for a request for the track information from the upper device based on the track information recorded in the PMA as described above.

[0011] However, when the optical disc is a DVD+R, for example, as mentioned above, the fragment information is recorded in the SDCBs corresponding to the respective sessions. Thus, it is necessary for a conventional optical disc device to sequentially search the SDCBs in the respective sessions dispersed in the record area. Accordingly, there is a problem in that the speed of response with respect to a track information obtaining request from the upper device, that is, the performance is significantly degraded.

[0012] Therefore, it is conceivable to obtain all fragment information in advance when an optical disc is set to the drive unit. However, because of a similar reason as in the case above, a considerable amount of time is required for obtaining all fragment information. Thus, there is a problem in that time until user access is made possible after the optical disc is set to the drive unit, so called disc mount time, is increased. Further, as mentioned above, the DVD+R allows up to 3056 fragments to exist thereon. For this reason, considering the memory capacity, it is difficult to store all fragment information in the memory of the drive unit.

[0013] Additionally, even in a case where designated fragment information is read from the disc when the user makes a request for the fragment information, since the fragment information exists in the SDCBs of the respective sessions in a dispersed manner as mentioned above, it is necessary to sequentially search for the SDCBs having the designated fragment. In this case, the performance with respect to the request for the fragment information by the user is significantly degraded.

[0014] Regarding such problems, for the DVD+R, a method has been proposed and is to be adopted as the standard where a session of which data recording is completed (closed session) is reported as one track to the user even when a plurality of fragments exist in the session. That is, when an obtaining request for the management information includes a request for obtaining the number of tracks, each of the closed sessions among the sessions included in the record area is regarded as one track (a pseudo-track) so as to calculate the number of tracks in response to the request. This is because there is no concept of the track in the DVD, the fragment in the DVD+R is for data recording, and thus individual fragment information in the session of which data recording is completed is not important. In other words, when recording data a write-once type disc such as the DVD+R requires information (fragment information) of tracks existing in sessions (open sessions) of which data recording is not completed. However, information (fragment information) of tracks in closed ses-

sions to which data recording cannot be further performed is not important. Thus, there is no inconvenience if the number of the closed sessions is given as an answer to the track number obtaining request.

[0015] As a result, it is not necessary to check SDCBs in all sessions with respect to the management information obtaining request. It is possible to immediately obtain the number of the pseudo-tracks only from the SCDB in the last session. Consequently, the number of tracks is, at the maximum, 206 (= 190 (the number of the pseudo-tracks) + 16 (the number of tracks in an open session)). Thus, as in the case of the CD-R, it is possible to store information of each track in the memory of the drive unit in advance. Accordingly, a method is used in which, with respect to the management information obtaining request by the user, management information recorded in the SCDB of the last session is always reported.

[0016] However, despite such a DVD+R environment, there may still be a request for obtaining individual fragment information in the closed sessions. For example, depending on a category where the drive unit is used, a case exists where there is a request for obtaining individual fragment information in the closed sessions so as to confirm the fragment information in data recording and the like.

[0017] In such a case, with respect to the management information obtaining request by the user, though the session information of the prior sessions is obtained, it is impossible to obtain the fragment information of the prior sessions, even if the management information is obtained from the SDCB of the last session. In other words, there is a problem in that the user cannot obtain individual fragment information in the closed sessions, since a means for reporting to the user the contents of the SDCBs of desired sessions does not exist, though individual fragment information in the closed sessions exists only in the SDCBs of the corresponding sessions.

SUMMARY OF THE INVENTION

[0018] It is a general object of the present invention to provide an improved and useful information reproducing apparatus, data management information obtaining method, data management information obtaining program, and storage medium in which the above-mentioned problems are eliminated.

[0019] It is another and more specific object of the present invention to provide an information reproducing apparatus, data management information obtaining method, data management information obtaining program, and storage medium that can obtain management information of a desired management information area without degrading performance even under a condition where a reproducing target is an information recording medium on which a plurality of the management information areas exist, each of which management information areas is updated and recorded in a new area every

time predetermined data recording is completed, regarding the management information.

[0020] It is still another object of the present invention to provide an information reproducing apparatus, data management information obtaining method, data management information obtaining program, and storage medium that can easily obtain fragment information in a desired session of which session data recording is completed, under a condition that a reproducing target is an information recording medium conforming to the standard of DVD+R.

[0021] It is a further object of the present invention to provide an information reproducing apparatus, data management information obtaining method, data management information obtaining program, and storage medium that can appropriately respond to designation by a user.

[0022] In order to achieve the above-mentioned objects, according to one aspect of the present invention, there is provided an information reproducing apparatus reproducing information of an information recording medium in which a record area is divided into a plurality of data areas, data are recorded for each of the divided data areas, management information relating to the data recording is recorded in a predetermined management information area, and the management information is updated and recorded in a new management information area every time predetermined data recording is completed, the information reproducing apparatus including: a receiving part receiving, from an external device, an obtaining request for the management information, the obtaining request including designation of a specific management information area; a management information obtaining part obtaining the management information relating to the data recording from the specific management information area designated in the received obtaining request; and a reporting part reporting, to the external device, the management information relating to the data recording obtained from the designated specific management information area.

[0023] According to the above-mentioned aspect of the present invention, the information reproducing apparatus is provided with an interface function that receives, from the external device, the obtaining request for the management information, which obtaining request includes the designation of the specific management information area, and obtains management information relating to data recording from the specific management information area designated in the received obtaining request. Thus, it is possible to obtain, without degrading performance, management information of the management information area that a user desires, even under a condition that a reproducing target is an information recording medium on which a plurality of the management information areas exist, and the management information area is updated and recorded in a new area every time predetermined data recording is completed with respect to the management information.

[0024] Also, the record area may include at least one session that includes a plurality of tracks as the data areas. In addition, the management information relating to the data recording, which management information is recorded in each of the management information areas, may include all track information in a session and all session information of sessions before the session.

[0025] Accordingly, it is possible to easily obtain the track information of a session by requesting for obtaining the management information with the designation of a desired management information area that belongs to the session of which track information is needed.

[0026] In addition, the information recording medium may be an information recording medium that conforms to the standard of DVD+R. Also, each of the management information areas may be a SDCB, and the track may be a fragment.

[0027] Accordingly, specifically, under a condition that the information recording medium that conforms to the standard of DVD+R is a reproducing target, it is possible to easily obtain, from the corresponding SDCB, fragment information in a desired session of which data recording is already completed.

[0028] Further, in the information reproducing apparatus according to the present invention, the reporting part may report, to the external device, the newest management information relating to data recording obtained from the designated specific management information area.

[0029] Accordingly, among the management information obtained from the specific management information area designated by the user via the external device, it is possible to report the newest management information that is added and updated.

[0030] Additionally, the information reproducing apparatus according to the present invention may further include a determining part determining whether or not the designated specific management information area exists on the information recording medium, wherein the reporting part makes an error report to the external device when the designated specific management information area does not exist.

[0031] Accordingly, when the management information area designated by the user via the external device does not exist on the information recording medium, since it is highly possible that an erroneous designation operation of management information area is performed, an error report is made. Thus, it is possible to avoid reporting, to the user, management information according to an erroneous management information area.

[0032] In addition, the information reproducing apparatus according to the present invention may further include a determining part determining whether or not the designated specific management information area exists on the information recording medium, wherein the reporting part reports, to the external device, management information relating to the data recording obtained

from a last management information area when the designated specific management information area does not exist.

[0033] Accordingly, when the management information area designated by the user via the external device does not exist on the information recording medium, an error report is not made, but management information of the last management information area is reported. Hence, it is possible for the user to obtain the management information of the last management information area without bothering himself/herself about the number of the management information areas existing on the information recording medium.

[0034] Furthermore, the information reproducing apparatus according to the present invention may further include a default value determining part determining whether or not the designated specific management information area corresponds to a specific default value, the specific default value being set in advance with respect to designation of the specific management information area, wherein the reporting part reports, to the external device, management information relating to the data recording obtained from a last management information area when the designated specific management information area is the default value.

[0035] Accordingly, when the management information area is not specifically designated but is the default value, the management information obtained from the last management information area is reported. Hence, it is possible to maintain the compatibility with a method that always obtains the management information from the last management information area.

[0036] Additionally, according to another aspect of the present invention, there is provided a data management information obtaining method for an information recording medium in which a record area is divided into a plurality of data areas, data are recorded for each of the divided data areas, management information relating to the data recording is recorded in a predetermined management information area, and the management information is updated and recorded in a new management information area every time predetermined data recording is completed, the data management information obtaining method including the steps of: receiving, from an external device, an obtaining request for management information, the obtaining request including designation of a specific management information area; obtaining management information relating to data recording from the specific management information area designated in the received obtaining request; and reporting, to the external device, the management information relating to the data recording obtained from the designated specific management information area.

[0037] Accordingly, the information reproducing apparatus is provided with an interface function that receives, from the external device, the obtaining request for the management information, which obtaining request includes the designation of the specific management

ment information area, and obtains management information relating to data recording from the specific management information area designated in the received obtaining request. Thus, it is possible to obtain, without degrading performance, management information of the management information area that a user desires, even under a condition that a reproducing target is an information recording medium on which a plurality of the management information areas exist, and the management information area is updated and recorded in a new area every time predetermined data recording is completed with respect to the management information.

[0038] Also, the data management information obtaining method may further include the step of: determining whether or not the designated specific management information area exists on the information recording medium, wherein the step of reporting makes an error report to the external device when the designated specific management information area does not exist.

[0039] Accordingly, when the management information area designated by the user via the external device does not exist on the information recording medium, since it is highly possible that an erroneous designation operation of management information area is performed, an error report is made. Thus, it is possible to avoid reporting, to the user, management information according to an erroneous management information area.

[0040] In addition, the data management information obtaining method according to the present invention may further include the step of: determining whether or not the designated specific management information area exists on the information recording medium, wherein the step of reporting reports, to the external device, management information relating to the data recording obtained from the last management information area when the designated specific management information area does not exist.

[0041] Accordingly, when the management information area designated by the user via the external device does not exist on the information recording medium, an error report is not made, but management information of the last management information area is reported. Hence, it is possible for the user to obtain the management information of the last management information area without bothering himself/herself about the number of the management information areas existing on the information recording medium.

[0042] The data management information obtaining method according to the present invention may further include the step of: determining whether or not the designated specific management information area corresponds to a specific default value, the specific default value being set in advance with respect to the designation of the specific management information area, wherein the step of reporting reports, to the external device, management information relating to the data recording obtained from the last management information

area when the designated specific management information area is the specific default value.

[0043] Accordingly, when the management information area is not specifically designated but is the default value, the management information obtained from the last management information area is reported. Hence, it is possible to maintain the compatibility with a method that always obtains the management information from the last management information area.

[0044] Additionally, according to another aspect of the present invention, there is provided a data management information obtaining program installed in a computer of an information reproducing apparatus reproducing information of an information recording medium in which a record area is divided into a plurality of data areas, data are recorded for each of the divided data areas, management information relating to the data recording is recorded in a predetermined management information area, and the management information is updated and recorded in a new management information area every time a predetermined data recording is completed, the data management information obtaining program causing the computer to carry out a data management information obtaining process including the instructions of: causing the computer to receive, from an external device, an obtaining request for management information, the obtaining request including designation of a specific management information area; causing the computer to obtain management information relating to data recording from the specific management information area designated in the received obtaining request; and causing the computer to report, to the external device, the management information relating to the data recording obtained from the designated specific management information area.

[0045] Accordingly, the data management information obtaining program causes the computer to carry out an interface function that receives, from the external device, the obtaining request for the management information, which obtaining request includes the designation of the specific management information area, and obtains management information relating to data recording from the specific management information area designated in the received obtaining request. Thus, it is possible to obtain, without degrading performance, management information of the management information area that a user desires, even under a condition that a reproducing target is an information recording medium on which a plurality of the management information areas exist, and the management information area is updated and recorded in a new area every time predetermined data recording is completed with respect to the management information.

[0046] The data management information obtaining program according to the present invention may further include the instruction of: causing the computer to determine whether or not the designated specific management information area exists on the information record-

ing medium, wherein the instruction of causing the computer to report causes the computer to carry out a process of making an error report to the external device when the designated specific management information area does not exist.

[0047] Accordingly, when the management information area designated by the user via the external device does not exist on the information recording medium, since it is highly possible that an erroneous designation operation of management information area is performed, an error report is made. Thus, it is possible to avoid reporting, to the user, management information according to an erroneous management information area.

[0048] In addition, the data management information obtaining program according to the present invention may further include the instruction of: causing the computer to determine whether or not the designated specific management information area exists on the information recording medium, wherein the instruction of causing the computer to report causes the computer to perform a process of reporting, to the external device, management information relating to data recording obtained from the last management information area when the designated specific management information area does not exist.

[0049] Accordingly, when the management information area designated by the user via the external device does not exist on the information recording medium, an error report is not made, but management information of the last management information area is reported. Hence, it is possible for the user to obtain the management information of the last management information area without bothering himself/herself about the number of the management information areas existing on the information recording medium.

[0050] Further, the data management information obtaining program according to the present invention may further include the instruction of: determining whether or not the designated specific management information area corresponds to a specific default value, said specific default value being set in advance with respect to the designation of the specific management information area, wherein the instruction of causing the computer to report causes the computer to report, to the external device, management information relating to data recording obtained from the last management information area when the designated specific management information area is the specific default value.

[0051] Accordingly, when the management information area is not specifically designated but is the default value, the management information obtained from the last management information area is reported. Hence, it is possible to maintain the compatibility with a method that always obtains the management information from the last management information area.

[0052] Additionally, according to another aspect of the present invention, there is provided a computer-reada-

ble storage medium storing the data management information obtaining program as described above.

[0053]   Accordingly, it is possible to obtain similar effects obtained from the data management information obtaining program.

[0054]   Other objects, features and advantages of the present invention will become more apparent from the following detailed description when read in conjunction with the following drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0055]

FIG. 1 is a block diagram showing a general structure of an optical disc device according to one embodiment of the present invention;

FIG. 2 is a schematic diagram showing an example of a multi-session format of a DVD+R;

FIG. 3 is a table showing an example of the format of a SDCB;

FIG. 4 is a table showing an example of the format of "Fragment Item";

FIG. 5 is a table showing an example of the format of "Previous Session Item"; and

FIG. 6 is a flow chart generally showing an example of a management information obtaining process.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0056]   A description will be given of one embodiment of the present invention, with reference to the drawings. FIG. 1 is a block diagram showing the general structure of an optical disc device 1 as an information reproducing apparatus according to the embodiment.

[0057]   The optical disc device 1 is constructed by a spindle motor 3 for driving an optical disc 2 as an information recording medium to rotate, an optical pickup unit 4, a laser control circuit 5, a motor driver 6, a reproduction signal processing circuit 7, a servo controller 8, a buffer RAM 9, a buffer manager 10, an interface 11, a ROM 12, a CPU 13, a RAM 14 and the like. It should be noted that arrows in FIG. 1 do not indicate all connections among the blocks, but indicate typical flows of signals and information.

[0058]   More specifically, first, as the optical disc 2, an information recording medium conforming to the standard of the DVD+R (hereinafter simply referred to as a "DVD+R") is targeted.

[0059]   The optical pickup unit 4 is constructed by including a semiconductor laser as a light source, an optical system that guides a laser beam emitted from the semiconductor laser to a storage surface of the optical disc 2 and includes an objective lens and the like guiding the returning beam reflected by the recording surface to a predetermined receiving position, a receiver arranged at the receiving position and receiving the returning

beam, driving systems (focusing actuator, tracking actuator, seek motor and the like)(none of them are shown), and the like. The receiver outputs, to the reproduction signal processing circuit 7, a current (electric current signal) according to the amount of light received.

[0060]   The servo controller 8 generates a control signal controlling the focusing actuator of the optical pickup unit 4 based on a focus error signal, and generates a control signal controlling the tracking actuator of the optical pickup unit 4 based on a track error signal. These control signals are output to the motor driver 6 from the servo controller 8.

[0061]   The motor driver 6 drives, based on the control signals from the servo controller 8, the focusing actuator and tracking actuator of the optical pickup unit 4. In addition, based on an instruction from the CPU 13, the motor driver 6 controls the spindle motor 3 so that the linear velocity of the optical disc 2 becomes constant. Further, based on an instruction from the CPU 13, the motor driver 6 drives the seek motor for the optical pickup unit 4 so as to radially move the optical pickup unit 4 toward a target track of the optical disc 2.

[0062]   The interface 11 is a two-way communication interface with a host (for example, a PC), which is an external device. The interface 11 conforms to the standard interfaces of ATAPI, SCSI, and the like.

[0063]   The CPU 13 constitutes, with the ROM 12 and the RAM 14, a microcomputer (computer) that the optical disc device 1 includes. The ROM 12 that also functions as a storage medium stores a program including a data management information obtaining program, as described later, written in a code decodable by the CPU 13. The CPU 13 controls the operation of each of the above-described parts according to the program stored in the ROM 12, and temporarily stores such data as necessary for the control in the RAM 14. It should be noted that the program stored in the ROM 12 is loaded (installed) to a main memory (not shown) of the CPU 13 when the power of the optical disc device 1 is turned ON.

[0064]   Next, a description will be given of an example of a multi-session format of the DVD+R constituting the optical disc 2 that is the target of this embodiment, by referring to a schematic diagram of FIG. 2. It should be noted that the file system of the optical disc 2 conforms to the sequential UDF standard.

[0065]   In the example shown in FIG. 2, for ease of explanation, a case is shown where two closed sessions, Sessions 1 and 2 of which data recording is completed, and one open session, Session 3 of which data recording is started but not completed exist on the optical disc 2, for example. Each of the Sessions 1, 2 and 3 includes three fragments (nine fragments indicated by Frag. No. 1 through 9). For each of the Sessions 1, 2 and 3, every time data recording of each session is completed, the SDCB (session disc control block) constituting a management information area is secured in a predetermined area, for example, a lead-in (or an intro), and management information relating to the data recording is record-

ed.

[0066] FIG. 3 shows an example of such a SDCB format. As shown in FIG. 3, the SDCB includes descriptions of "Contents Descriptor", "Unknown Contents Descriptor Actions", "Drive ID", "Session Number" and the like. Further, as information specific to the SDCB, the SDCB includes a plurality of (0 through N) "Session Items", each being constructed by 16 bytes.

[0067] Such "Session Item" includes two kinds: Fragment Item indicating fragment information in the session; and Previous Session Item indicating session information of the sessions before this session.

[0068] FIG. 4 shows an example of the format of the "Fragment Item". The format of the "Fragment Item" is set such that the fragment information of "Fragment number", "Fragment start address", "Fragment end address" and the like is written as the management information. Such "Fragment Item" is prepared, as one of the "Session Items", for each fragment existing in the session. In the example shown in FIG. 2, three "Fragment Items" exist for each of the SDCBs.

[0069] FIG. 5 shows an example of the format of the "Previous Session Item". The format of the "Previous Session Item" is set such that session information of "Previous session number", "Previous session start address", "Previous session end address" and the like are written as the management information. Such "Previous Session Item" is prepared, as one of the "Session Items", for each session existing before the session.

[0070] Each of the SDCBs includes a recordable area. The information of the SDCB is added in a similar manner when a track or a session is added, for example.

[0071] Returning to FIG. 2, in the multi-session format as shown in FIG. 2, with respect to the closed sessions as indicated by the Sessions 1 and 2, the optical disc device 1 is set so as to make a report, to the host, by regarding each of the sessions as one track, even if a plurality of tracks (fragments) exist in the session. Accordingly, as shown in FIG. 2, the track numbers of the closed sessions are equal to the session numbers. On the other hand, with respect to the open session as indicated by the Session 3, the number of fragments matches the number of tracks. That is, the track number of the first track of the open session is the session number, and the track numbers thereafter are incremented one by one. In the example shown in FIG. 2, the fragment numbers 1 through 3 are regarded as the track number 1, the fragment numbers 4 through 6 are regarded as the track number 2, and the fragment numbers 7, 8 and 9 are regarded as the track numbers 3, 4 and 5, respectively.

[0072] Thus, under such a condition, it is possible to immediately obtain the fragment information in the session 3 and the number of tracks in the record area, by obtaining and reporting the management information that is written in the last SDCB included in the Session 3, which is the last session, with respect to the management information obtaining request from the host side.

Therefore, setting is made such that the last SDCB included in the last session becomes the target of the management information obtaining request from the host side.

[0073] Under such a condition, with respect to the previous sessions, only the session information is obtained and the fragment information cannot be obtained. In other words, there is a problem in that the user cannot obtain individual fragment information in the closed sessions, since a means for reporting, to the host, the contents of the SDCB of a desired session does not exist, though individual fragment information in the closed sessions exists only in the SDCB of the corresponding session. In the example shown in FIG. 2, it is impossible to obtain the fragment information with respect to the fragment numbers 1 through 6.

[0074] Thus, in this embodiment, an interface is added that can provide access to the SDCB of a desired session and obtain the fragment information in the session so that even the management information of past SDCBs can be arbitrarily reported.

[0075] A description will be given of an example of control of a data management information obtaining process carried out by the CPU 13 in the optical disc device 1 according to this embodiment, with reference to the flow chart shown in FIG. 6. In this embodiment, in order to add the above-described interface, it is assumed that the host side designates the session number so as to specify a desired SDCB when making an obtaining request for the management information. When specifying the SDCB by designating the session number, it is possible to specify the last SDCB belonging to the last session by inputting the session number thereof. However, it is assumed that a field for designating the session number is normally set to a default setting (in this embodiment, a session number "0", which does not exist on the optical disc 2, is set) so that the last SDCB can be designated without specifically designating the session number.

[0076] Additionally, in the optical disc device 1, when the optical disc 2 is mounted to a predetermined position of the optical disc device 1, the CPU 13 obtains information relating to the closed session recorded on a predetermined position in the record area of the optical disc 2, extracts the address of the last closed session based on the information, and checks whether or not an open session exists following the closed session. When an open session exists, the record contents of the SDCB of the open session are read and copied to the RAM 14. When an open session does not exist, the record contents of the SDCB of the last closed session are read and copied to the RAM 14. In other words, it is assumed that prior to the process of this embodiment, which is to be explained by using FIG. 6, the management information of the last SDCB is already copied to the RAM 14. In the example of FIG. 2, the management information written in the last SDCB included in the Session 3 is copied to the RAM 14.

[0077] First, when there is a request for obtaining management information with the designation of the session number from the host side, the designated session number is obtained in step S1 When the designated session number is obtained, it is determined whether or not the session of the session number exists on the optical disc 2 in step S2. The determination is made based on the limitation that the number of sessions that can exist on the optical disc 2 is up to 191 sessions in a case of a DVD+R, and by referring to the session information obtained from the last SDCB and already stored in the RAM 14.

[0078] When the session of the designated session number exists on the optical disc 2 (YES in step S2), the management information as shown in FIGS. 3 through 5 recorded in the SDCB belonging to the session of the designated session number is read from the optical disc 2 in step S3. As access control to the SDCB in this case, for example, referring to the management information of the last SDCB already stored in the RAM 14, the session start address of the designated session may be read, and the SDCB of the target session may be searched based on the address. By reading the SDCB, it is possible to obtain the management information such as the number of each fragment existing in the session, and the fragment information such as the address and the like. For instance, in the example shown in FIG. 2, when the Session 2 is designated, it is possible to obtain, from the SDCB belonging to the Session 2, the fragment information relating to the fragments 4, 5 and 6 in the Session 2.

[0079] Thereafter, in step S4, the management information including the fragment information obtained from the SDCB of the designated session is reported to the host side (user), and the management information obtaining process ends. The contents of the management information reported to the host side are the newest management information in the session of the session number that is designated by the user. For example, when there is a session deletion or the like before the session designated by the user, management information including the deletion information is reported.

[0080] On the other hand, when the session of the designated session number does not exist on the optical disc 2 (NO in step S2), in step S5, it is determined whether or not the session number is a default value with respect to the session number designation of the optical disc device 1. This is because, in this embodiment, the default value with respect to the session number designation is set to the session number 0.

[0081] As a result of the determination, when the session number is not the default value but the session number does not exist on the optical disc 2 (NO in step S5), no particular process is performed, and an error report is made to the host side via the interface 11 in step S6.

[0082] Accordingly, when the session number designated by the user via the host does not exist on the optical disc 2, it is highly possible that an erroneous session number designation operation is made. Thus, by making an error report, it is possible to avoid reporting, to the user, the management information of an erroneous SDCB.

[0083] In addition, when the designated session number is the default value (YES in step 35), the management information including the fragment information obtained from the last SDCB is reported to the host side via the interface 11 in step S7, and the management information obtaining process ends. Since the management information obtained from the last SDCB is already stored in the RAM 14, the report in this case is made by reading the management information from the RAM 14.

[0084] That is, as mentioned above, when a method is employed where the management information is always obtained from the last SDCB, the user makes the management information obtaining request without designating the session number. Even in a method where the designation of the session number is required as in this embodiment, the field for designating the session number is set to the session number 0 as the default setting so that input of a specific number is not required even when the last SDCB is to be designated. However, when the error report (step S6) is made on the grounds that the session number 0 does not exist on the optical disc 2, compatibility with the method where the management information is always obtained from the last SDCB is lacking. Thus, the last session number to which the last SDCB belongs must be designated. In that respect, it is possible to maintain compatibility with the method where the management information is always obtained from the last SDCB by reporting the management information obtained from the last SDCB when the session number is not specifically designated but the default value is set.

[0085] Further, when the designated session number does not exist on the optical disc 2 (NO in step 32), as indicated by a two-dot chain line in FIG. 6, without making the error report (step S6) whether the session number is the default value or not, the management information including the fragment information obtained from the last SDCB may be reported to the host side via the interface 11 (step S7), and the management information obtaining process may be ended. Since the management information obtained from the last SDCB is already stored in the RAM 14, the report in this case is performed by reading the management information from the RAM 14.

[0086] In other words, it is possible for the user to obtain the management information of the last SDCB without bothering himself/herself about the number of sessions existing on the optical disc 2 when the session number that is designated by the user via the host does not exist on the optical disc 2. For example, in the DVD+R as in this embodiment, up to 191 sessions can exist. However, when a session number larger than this is designated intentionally, it is possible to obtain the

management information of the last SDCB, irrespective of the number of sessions existing on the optical disc 2. Accordingly, it is possible to correspond to a case where the default value for obtaining the management information of the last SDCB is not set.

[0087] Further, in this embodiment, the description has been given for the case where the optical disc 2 is a DVD+R. However, the present invention may be applied to information recording media on which data recording is made by dividing the record area into a plurality of data areas such as sessions and tracks, management information relating to the data recording is recorded in predetermined management information areas, and the management information is updated and recorded to a new management information area every time predetermined data recording is completed.

[0088] Also, the optical disc device 1 of this embodiment may be a so-called built-in type, which is arranged in the same housing as that of the host, or a so-called external type, which is arranged in a housing different from that of the host.

[0089] Furthermore, the description has been given of the case where the optical disc device is used as the information reproducing apparatus. However, information reproducing apparatuses capable of using information recording media on which data recording is made by dividing the record area into a plurality of data areas such as sessions and tracks, management information relating to the data recording is recorded in predetermined management information areas, and the management information is updated and further recorded to a new management information area every time a predetermined data recording is completed may be used. Of course, information recording/reproducing apparatuses having a recording function as well as a reproducing function may be used.

[0090] The present invention is not limited to the specifically disclosed embodiments, and variations and modifications may be made without departing from the scope of the present invention.

Claims

1. An information reproducing apparatus reproducing information of an information recording medium in which a record area is divided into a plurality of data areas, data are recorded for each of the divided data areas, management information relating to the data recording is recorded in a predetermined management information area, and the management information is updated and recorded in a new management information area every a time predetermined data recording is completed **characterized in that** said information reproducing apparatus further comprises:

    a receiving part receiving, from an external de-

vice, an obtaining request for the management information, said obtaining request including designation of a specific management information area;
a management information obtaining part obtaining the management information relating to the data recording from the specific management information area designated in the received obtaining request; and
a reporting part reporting, to the external device, the management information relating to the data recording obtained from the designated specific management information area.

2. The information reproducing apparatus as claimed in claim 1, wherein the record area includes at least one session having a plurality of tracks as the data areas, and the management information relating to the data recording recorded in each of the management information areas includes all track information of the session and all session information of sessions recorded before the session.

3. The information reproducing apparatus as claimed in claim 2, wherein the information recording medium conforms to a standard which is the DVD+R standard, each of the management information areas is a session disc control block, and each of the tracks is a fragment.

4. The information reproducing apparatus as claimed in one of claims 1-3, wherein the reporting part reports, to the external device, newest management information relating to the data recording obtained from the designated specific management information area.

5. The information reproducing apparatus as claimed in one of claims 1-3, further comprising:

    a determining part determining whether or not the designated specific management information area exists on the information recording medium,

    wherein, the reporting part makes an error report to the external device when the designated specific management information area does not exist.

6. The information reproducing apparatus as claimed in one of claims 1-3, further comprising:

    a determining part determining whether or not the designated specific management information area exists on the information recording medium,

wherein the reporting part reports, to the external device, the management information relating to the data recording obtained from a last management information area when the designated specific management information area does not exist.

7. The information reproducing apparatus as claimed in one of claims 1-3, further comprising:

a default value determining part determining whether or not the designated specific management information area corresponds to a specific default value, said specific default value being set in advance with respect to the designation of the specific management information area,

wherein the reporting part reports, to the external device, the management information relating to the data recording obtained from a last management information area when the designated specific management information area is the specific default value.

8. A data management information obtaining method for an information recording medium in which a record area is divided into a plurality of data areas, data are recorded for each of the divided data areas, management information relating to the data recording is recorded in a predetermined management information area, and the management information is updated and recorded in a new management information area every time a predetermined data recording is completed, said data management information obtaining method **characterized by** the steps of:

receiving, from an external device, an obtaining request for the management information, said obtaining request including designation of a specific management information area; obtaining the management information relating to the data recording from the specific management information area designated in the received obtaining request; and reporting, to the external device, the management information relating to the data recording obtained from the designated specific management information area.

9. The data management information obtaining method as claimed in claim 8, further comprising the step of:

determining whether or not the designated specific management information area exists on the information recording medium,

wherein the step of reporting the manage-

ment information makes an error report to the external device when the designated specific management information area does not exist.

10. The data management information obtaining method as claimed in claim 8, further comprising the step of:

determining whether or not the designated specific management information area exists on the information recording medium,

wherein the step of reporting the management information reports, to the external device, the management information relating to the data recording obtained from a last management information area when the designated specific management information area does not exist.

11. The data management information obtaining method as claimed in claim 8 or 9, further comprising the step of:

determining whether or not the designated specific management information area corresponds to a specific default value, said specific default value being set in advance with respect to the designation of the specific management information area,

wherein, when the designated specific management information area is the specific default value, the step of reporting the management information reports, to the external device, the management information relating to the data recording obtained from a last management information area.

12. A data management information obtaining program installed in a computer of an information reproducing apparatus reproducing information of an information recording medium in which a record area is divided into a plurality of data areas, data is recorded for each of the divided data areas, management information relating to the data recording is recorded in a predetermined management information area, and the management information is updated and recorded in a new management information area every time predetermined data recording is completed, said data management information obtaining program for causing the computer to carry out a management information obtaining process comprising the instructions of:

causing the computer to receive, from an external device, an obtaining request for management information, said obtaining request including designation of a specific management information area;

causing the computer to obtain the management information relating to the data recording from the specific management information area designated in the received obtaining request; and
causing the computer to report, to the external device, the management information relating to the data recording obtained from the designated specific management information area.

13. The data management information obtaining program as claimed in claim 12, further comprising the instruction of:

causing the computer to determine whether or not the designated specific management information area exists on the information recording medium,

wherein the instruction of causing the computer to report the management information causes the computer to carry out a process of making an error report to the external device when the designated specific management information area does not exist.

14. The data management information obtaining program as claimed in claim 12, further comprising the instruction of:

causing the computer to determine whether or not the designated specific management information area exists on the information recording medium,

wherein the instruction of causing the computer to report the management information causes the computer to perform a process of reporting, to the external device, the management information relating to the data recording obtained from a last management information area when the designated specific management information area does not exist.

15. The data management information obtaining program as claimed in claim 12 or 13, further comprising the instruction of:

causing the computer to determine whether or not the designated specific management information area corresponds to a specific default value, said specific default value being set in advance with respect to the designation of the specific management information area,

wherein the instruction of causing the computer to report the management information causes the computer to report, to the external device, the

management information relating to the data recording obtained from a last management information area when the designated specific management information area is the specific default value.

16. A computer-readable storage medium storing a data management information obtaining program, said data management information obtaining program being installed to a computer of an information reproducing apparatus reproducing information of an information recording medium in which a record area is divided into a plurality of data areas, data are recorded for each of the divided data areas, management information relating to the data recording is recorded in a predetermined management information area, and the management information is updated and recorded in a new management information area every time a predetermined data recording is completed, and said data management information obtaining program for causing the computer to carry out a data management information obtaining process comprising the instructions of:

causing the computer to receive, from an external device, an obtaining request for management information, said obtaining request including designation of a specific management information area;
causing the computer to obtain the management information relating to the data recording from the specific management information area designated in the received obtaining request; and
causing the computer to report, to the external device, the management information relating to the data recording obtained from the designated specific management information area.
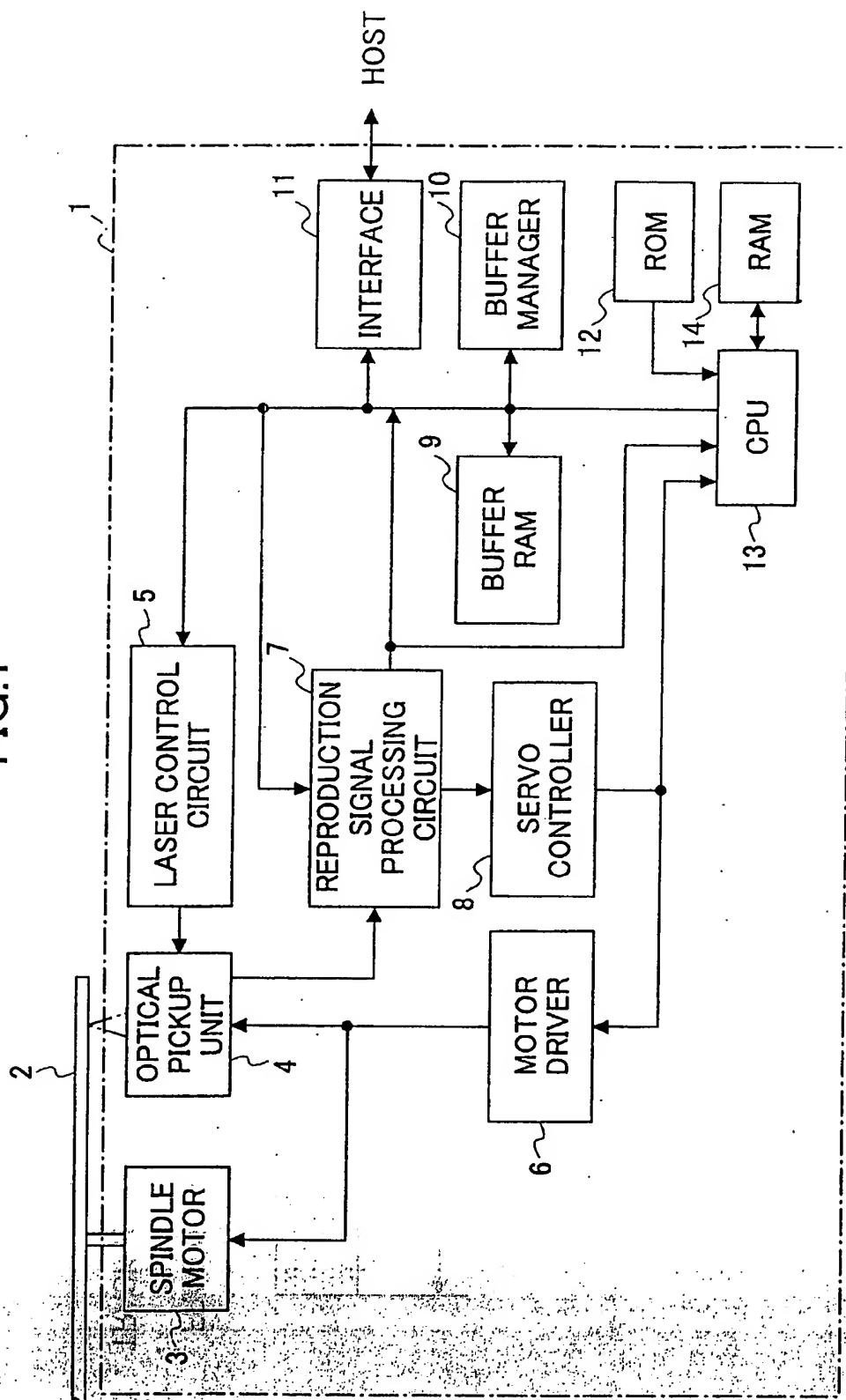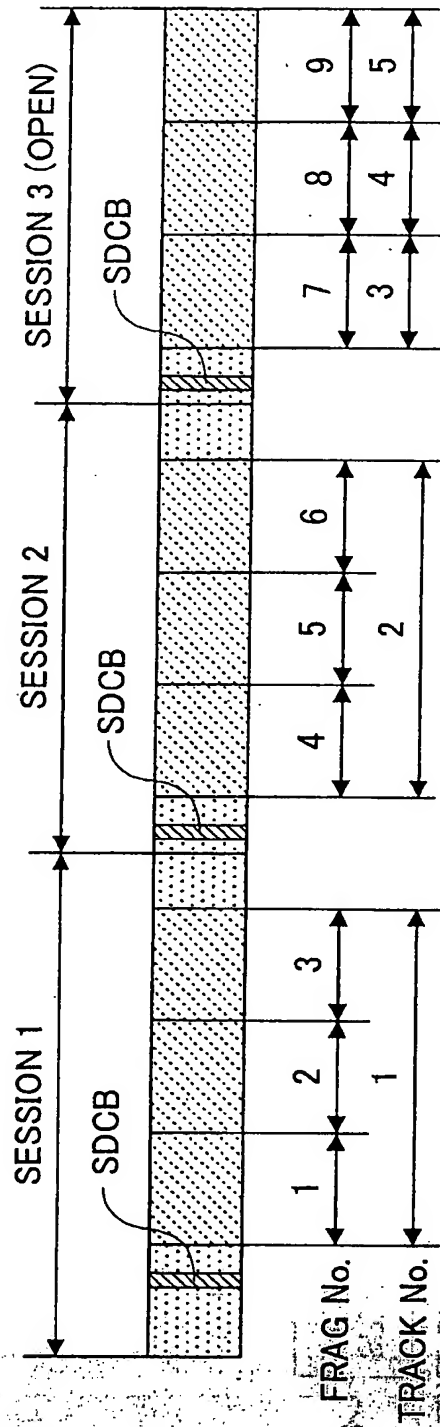
FIG.1

FIG.2

FIG.3

FORMAT OF SDCB

PHYSICAL SECTOR OF ECC BLOCK	MAIN DATA BYTE POSITION	DESCRIPTION	NUMBER OF BYTES
0	D0 TO D3	CONTENTS DESCRIPTOR	4
0	D4 TO D7	UNKNOWN CONTENTS DESCRIPTOR ACTIONS	4
0	D8 TO D39	DRIVE ID	32
0	D40 TO D42	SESSION NUMBER	2
0	D42 TO D63	RESERVED	22
0	D64 TO D95	DISC ID (IN LEAD-IN ZONE ONLY)	32
0	D96 TO D127	APPLICATION DEPENDENT	32
0	D128 TO D143	SESSION ITEM 0	16
0	...	...	
0	D128+I×16 TO D143+I×16	SESSION ITEM I	16
0	...	...	
0	D128+(N-1)×16 TO D143+(N-1)×16	SESSION ITEM N	16
0	D128+N×16 TO D2047	RESERVED	1920-N×16
1 TO 15	D0 TO D2047	RESERVED	15×1048

FIG.4

FRAGMENT ITEM

ITEM BYTE POSITION	DESCRIPTION	NUMBER OF BYTES
B0 TO B2	FRAGMENT ITEM DESCRIPTOR	3
B3 TO B4	FRAGMENT NUMBER	2
B5TO B7	FRAGMENT START ADDRESS	3
B8 TO B10	FRAGMENT END ADDRESS	3
B11 TO B15	RESERVED	5

FIG.5

PREVIOUS SESSION ITEM

ITEM BYTE POSITION	DESCRIPTION	NUMBER OF BYTES
B0 TO B2	PREVIOUS SESSION ITEM DESCRIPTOR	3
B3	RESERVED	1
B4	PREVIOUS SESSION NUMBER	1
B5 TO B7	PREVIOUS SESSION START ADDRESS	3

FIG.6

SDCB OBTAINING REQUEST

OBTAIN DESIGNATED SESSION NUMBER — S1

DESIGNATED SESSION EXISTS? — S2

NO →

YES ↓

READ SDCB OF DESIGNATED SESSION — S3

REPORT SDCB TO USER — S4

DEFAULT VALUE? — S5

NO →

YES ↓

ERROR REPORT — S6

REPORT NEWEST SDCB TO USER — S7

END SDCB OBTAINING PROCESS
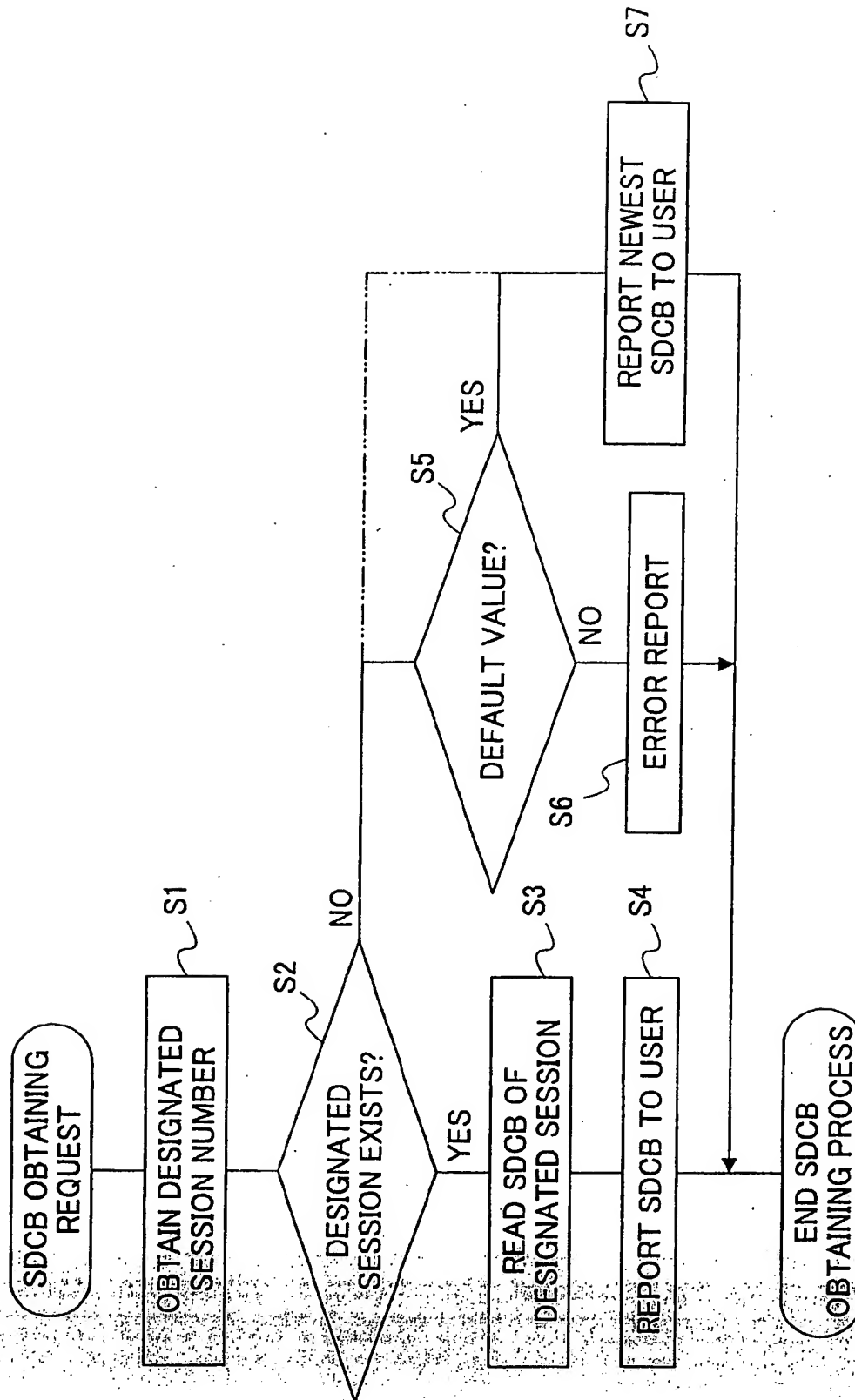
(19)

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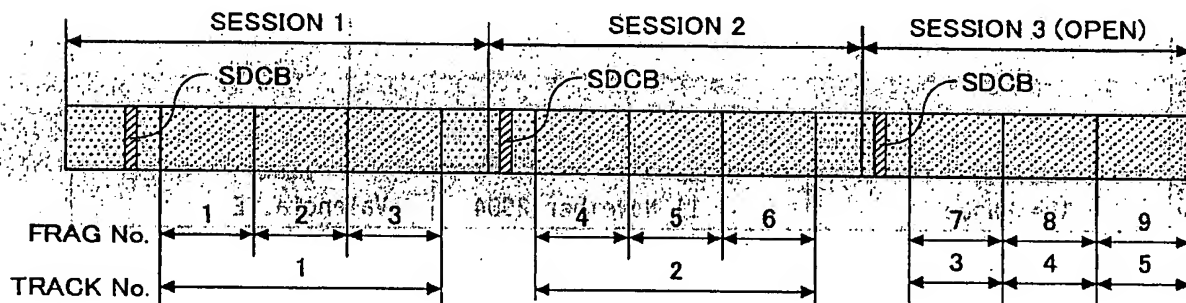MARKS & CLERK,
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(54) **Information reproducing apparatus, data management information obtaining method, data management information obtaining program, and storage medium**

(57) An information reproducing apparatus reproducing information of an information recording medium is disclosed. In the information recording medium, a record area is divided into a plurality of data areas. Also, data are recorded for each of the divided data areas (SDCB). In addition, management information relating to the data recording is recorded in a predetermined management information area. Further, the management information is updated and recorded in a new management information area every time a predetermined data recording is completed. A receiving part receives, from an external device, an obtaining request for the management information. The obtaining request includes designation of a specific management information area. A management information obtaining part obtains the management information relating to the data recording from the specific management information area designated in the received obtaining request. A reporting part reports, to the external device, the management information relating to the data recording obtained from the designated specific management information area.

FIG.2

European Patent Office

DECLARATION

which under Rule 45 of the European Patent Convention shall be considered, for the purposes of subsequent proceedings, as the European search report

Application Number

EP 03 25 0017

	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
The Search Division considers that the present application, does not comply with the provisions of the EPC to such an extent that it is not possible to carry out a meaningful search into the state of the art on the basis of all claims	G11B27/32 G11B20/12 G11B20/10

Reason:

The application contains a single embodiment of the invention claimed, namely a multisession DVD+R reproducing apparatus, together with the corresponding method, reproducing program and medium. According to the description, the DVD+R is "conforming to the standard of the DVD+R" (page 26, lines 18-19).
The standard of the DVD+R is therefore very relevant prior art to perform a meaninful search, but it is not available to the public at the date of priority of the present application. In particular, a non-disclosure agreement has to be signed in order to buy it, see www.licensing.philips.com.
Moreover, the recording structure of the only embodiment is only superficially presented within the description. Hence, the present application does not contain a detailed description of at least one way of carrying out the invention claimed, ar required by rule 27(1e) EPC, and therefore the invention is insufficiently disclosed, contrary to article 83 EPC.

The applicant's attention is drawn to the fact that a search may be carried out during examination following a declaration of no search under Rule 45 EPC, should the problems which led to the declaration being issued be overcome (see EPC Guideline C-VI, 8.5).

Place of search	Date	Examiner
The Hague	11 November 2004	Valencia, E

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(54) Information editing apparatus, information editing method, and information recording medium

(57) An information editing apparatus (S) for editing recording information already recorded on a write-once recording medium (1) such as DVD-R is provided. In the apparatus, a remaining capacity in the DVD-R is detected (step S22). Then, it is determined whether the recording information can be edited or not on the basis of the detected remaining capacity and an amount of information to be recorded in the unrecorded area by editing the recording information (step S23). Further, a result of the determination is notified (step S24).

FIG. 5
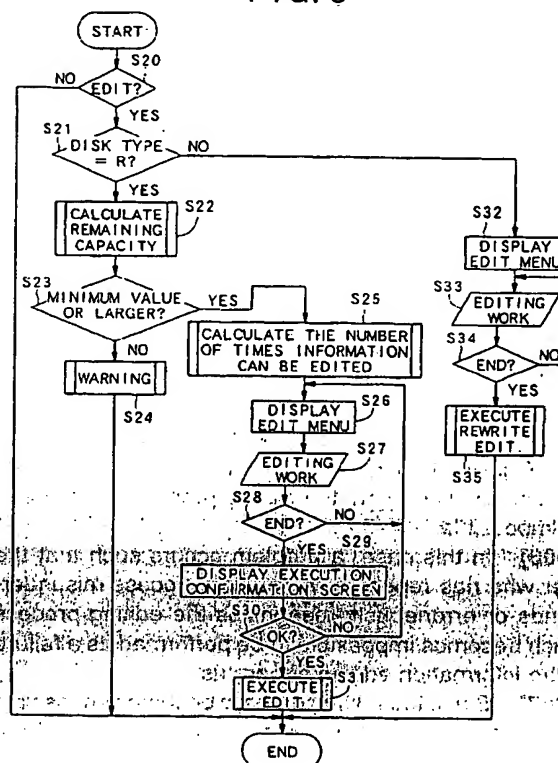
Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001]   The present invention relates to a technical field of an information editing apparatus, an information editing method, and an information recording medium on which a program for controlling edit is recorded so as to be read by a computer. More particularly, the invention relates to a technical field of an information editing apparatus and method for editing recording information already recorded on a write-once recording medium, and an information recording medium on which a program for controlling edit is recorded so as to be read by a computer.

2. Description of the Related Art

[0002]   As the recording density of a recording medium such as an optical disk is increasing in recent years, the recording density of a recording medium on which information can be recorded only once but cannot be overwritten (hereinafter, referred to as a write-once recording medium), such as what is called a DVD-R (DVD-Recordable) is also becoming remarkably higher.
[0003]   The recording information recorded on the write-once recording medium usually includes not only the recording information itself such as music information or image information to be reproduced but also reproduction control information (generally, also called navigation information) indicative of a reproduction mode, which is specifically a reproduction order of plural recording information, the number of reproduction times, a reproduction range, or the like.
[0004]   Assuming now that an editing process of deleting all or a part of recording information already recorded on the write-once recording medium, since information can be written only once to the write-once recording medium as described above, the original reproduction control information is not overwritten with the edited reproduction control information but the whole edited reproduction control information is quite separately and newly recorded in an available area at that time.
[0005]   When the editing process is seen from the user's point of view, however, the available capacity decreases in spite of no newly added recording information. Finally, although any recording information is not additionally increased, the editing process becomes to be impossible.
[0006]   In this case, a problem occurs such that the user who has repeated the editing process misunderstands or erroneously recognizes the editing process which becomes impossible to be performed as a failure of the information editing apparatus.
[0007]   Since the editing process becomes impossible to be performed without any information provided, there

is also a problem such that an unnecessary and preliminary editing process is repeated and a necessary editing process cannot be executed.

SUMMARY OF THE INVENTION

[0008]   The present invention has been made in view of the above problems and its object is to provide an information editing apparatus and method capable of preventing the user from erroneously recognizing that the editing process can be performed and capable of allowing a necessary editing process to be effectively executed, and an information recording medium on which a program for controlling edit is recorded so as to be read by a computer.
[0009]   The above object of the present invention can be achieved by an information editing apparatus of the present invention for editing recording information already recorded on a recording medium on which information can be recorded only once. The apparatus is provided with: a remaining capacity detecting device for detecting a remaining capacity as a recording capacity of an unrecorded area on said recording medium; a determining device for determining whether said recording information can be edited or not on the basis of said detected remaining capacity and an amount of information to be recorded in said unrecorded area by editing said recording information; and a notifying device for notifying a result of said determination.
[0010]   According to the present invention, since whether the recording information recorded on the write-once recording medium can be edited or not is notified, the user can recognize the state before executing an actual editing process. Consequently, in the case of editing recording information already recorded on the recording medium, the user can be prevented from erroneously recognizing that the information cannot be edited even if a remaining capacity decreases regardless of additionally recording new recording information, and a necessary edit can be effectively executed.
[0011]   In one aspect of the present invention, said determining device determines the number of times said recording information can be edited after said determination, and said notifying device notifies said determined number of times.
[0012]   According to this aspect, the user can recognize the specific number of times information can be edited before executing an actual edit.
[0013]   In another aspect of the present invention, said determining device determines whether said recording information can be edited or not after said determination, and said notifying device notifies whether said recording information can be edited or not.
[0014]   According to this aspect, the user can therefore recognize whether the information can be edited or not before executing an actual edit.
[0015]   In further aspect of the present invention, editing of said recording information is deletion of all or a

part of said recording information recorded on said recording medium.

[0016] According to this aspect, the user can therefore recognize whether recording information can be deleted or not before deleting a part or all of the recording information recorded.

[0017] In further aspect of the present invention, said information to be recorded in said unrecorded area including reproduction control information for preventing said deleted recording information from being reproduced.

[0018] According to this aspect, the reproduction control information to make the information apparently deleted in the reproduction information after the deleting process is recorded.

[0019] The above object of the present invention can be achieved by an information editing method of the present invention of editing recording information already recorded on a recording medium on which information can be recorded only once. The method is provided with: a remaining capacity detecting process of detecting a remaining capacity as a recording capacity of an unrecorded area on said recording medium; a determining process of determining whether said recording information can be edited or not on the basis of said detected remaining capacity and an amount of information to be recorded in said unrecorded area by editing said recording information; and a notifying process of notifying a result of said determination.

[0020] According to the present invention, since whether recording information recorded on a write-once recording medium can be edited or not is notified, the user can recognize it before executing an actual edit. Consequently, in the case of editing recording information already recorded on the recording medium, the user can be prevented from erroneously recognizing that the information cannot be edited even if a remaining capacity decreases regardless of additionally recording new recording information, and a necessary edit can be effectively executed.

[0021] In one aspect of the present invention, the number of times said recording information can be edited after said determination is determined in said determining process, and said determined number of times is notified in said notifying process.

[0022] According to this aspect, the user can therefore recognize the specific number of times information can be edited before executing an actual edit.

[0023] In another aspect of the present invention, whether said recording information can be edited or not is determined after said determination in said determining process, and whether said recording information can be edited or not is notified in said notifying process.

[0024] According to this aspect, the user can therefore recognize whether the information can be edited or not before executing an actual edit.

[0025] In further aspect of the present invention, editing of said recording information is deletion of all or a

part of said recording information recorded on said recording medium.

[0026] According to this aspect, the user can therefore recognize whether recording information can be deleted or not before deleting a part or all of the recording information recorded.

[0027] In further aspect of the present invention, said information to be recorded in said unrecorded area including reproduction control information for preventing said deleted recording information from being reproduced.

[0028] According to this aspect, the reproduction control information to make the information apparently deleted in the reproduction information after the deleting process is recorded.

[0029] The above object of the present invention can be achieved by an information recording medium of the present invention on which a program for controlling an edit is recorded so as to be read by an editing computer included in an information editing apparatus of editing recording information already recorded on a recording medium on which information can be recorded only once. The program causes said editing computer to function as: a remaining capacity detecting device for detecting a remaining capacity as a recording capacity of an unrecorded area on said recording medium; a determining device for determining whether said recording information can be edited or not on the basis of said detected remaining capacity and an amount of information to be recorded in said unrecorded area by editing said recording information; and a notifying device for notifying a result of said determination.

[0030] According to the present invention, since the editing computer is allowed to function to notify of whether recording information recorded on a write-once recording medium can be edited or not, the user can recognize the state before executing an actual edit. Consequently, in the case of editing recording information already recorded on the recording medium, the user can be prevented from erroneously recognizing that the information cannot be edited even if a remaining capacity decreases regardless of additionally recording new recording information, and a necessary edit can be effectively executed.

[0031] In one aspect to the present invention, said determining device determine the number of times said recording information can be edited after said determination, and said notifying device notifies said determined number of times.

[0032] According to the present invention, the user can therefore recognize the specific number of times information can be edited before executing an actual edit.

[0033] In another aspect of the present invention, said determining device determines whether said recording information can be edited or not after said determination, and said notifying device notifies whether said recording information can be edited or not.

[0034] According to this aspect, the user can there-

fore recognize whether the information can be edited or not before executing an actual edit.

[0035]   In further aspect of the present invention, editing of said recording information is deletion of all or a part of said recording information recorded on said recording medium.

[0036]   According to the present invention, the user can therefore recognize whether recording information can be deleted or not before deleting a part or all of the recording information recorded.

[0037]   In further aspect of the present invention, said information to be recorded in said unrecorded area including reproduction control information for preventing said deleted recording information from being reproduced.

[0038]   According to this aspect, the reproduction control information to make the information apparently deleted in the reproduction information after the deleting process is recorded.

BRIEF DESCRIPTION OF THE DRAWINGS

[0039]

Fig. 1 is a diagram showing a deleting process in a DVD-R 1;

Fig. 2 is a diagram showing a concrete example of an information amount of a border-out area;

Fig. 3 is a block diagram showing a schematic configuration of an information recording/reproducing apparatus of an embodiment of the present invention;

Fig. 4 is a flowchart (I) of an editing process of the embodiment;

Fig. 5 is a flowchart (II) of an editing process of the embodiment;

Fig. 6A is a diagram showing concrete example (I) of a setup screen of an edit menu;

Fig. 6B is a diagram showing concrete example (I) of a setup screen of an edit menu with indication of the number of times information can be edited;

Fig. 7A is a diagram showing a concrete example (II) of a setup screen of individual edit screens;

Fig. 7B is a diagram showing a concrete example (II) of a setup screen of an edit menu of individual edit.

Fig. 8A is a diagram showing a concrete example (III) of a setup screen of an execution confirmation screen;

Fig. 8B is a diagram showing a concrete example (III) of a setup screen of a warning screen;

Fig. 9 is a flowchart showing an editing process of a first modification of the invention; and

Fig. 10 is a flowchart showing an editing process of a second modification of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0040]   Preferred embodiments of the invention will be described with reference to the drawings.

[0041]   Embodiments of the invention relate to an information recording/reproducing apparatus as an information editing apparatus capable of editing recording information already recorded on a DVD-R as a write-once recording medium.

I. Embodiment of Recording Format

[0042]   Before explaining the embodiment of the information recording/reproducing apparatus, a recording format of a DVD-R as a recording medium according to the embodiment will be described first by referring to Figs. 1 and 2.

[0043]   Fig. 1 shows recording formats of recording information recorded on the DVD-R before and after executing an editing process of deleting a part of the recording information already recorded on the DVD-R only once. The left side of Fig. 1 shows the recording format before the editing process is executed, and the right side of Fig. 1 shows the recording format after the editing process is executed. Fig. 2 is a diagram showing a concrete example of an amount of information recorded as a border area which will be described later.

[0044]   First, as shown in the left side of Fig. 1, after a recording process of recording information onto a DVD-R 1 is executed, a lead-in area LI, a file system area FS, a reproduction control information area NV, a backup area BP, a recording information area DT, a border-out area BO, and a empty area EP are formed on the DVD-R 1 in accordance with this order from the inner radius side.

[0045]   In the lead-in area LI, start information as control information necessary to start reproducing the recording information recorded on the whole DVD-R 1 is recorded.

[0046]   In the file system area FS, file system information indicative of a hierarchical structure of the reproduction control information recorded in the reproduction control information area NV is recorded.

[0047]   In the reproduction control information area NV, the reproduction control information indicative of a reproduction mode of the recording information recorded in the recording information area DT is recorded.

[0048]   In the backup area BP, as backup information used in the case where the reproduction control information recorded in the reproduction control information area NV cannot be read for some reason (such as a blemish on the DVD-R 1), the same reproduction control information is recorded.

[0049]   In the recording information area DT, the recording information recorded on the DVD-R 1 by the recording process of once is stored.

[0050]   In the border-out area BO, temporary end in-

formation necessary to temporarily finish the recording of the recording information is recorded. That is, by the information, the recording of the whole DVD-R 1 is not finished but the recording operation is temporarily finished in a state where the empty area EP is left.

[0051] The area on the DVD-R 1 other than the above-described areas is left as it is as a empty area EP in which no information is recorded.

[0052] The recording format of the information recorded on the DVD-R 1 after the editing process of (seemingly) deleting a part of the recording information recorded on the DVD-R 1 in a state the recording process of once is finished is performed once will be described by referring to the right side of Fig. 1.

[0053] As shown in the right side of Fig. 1, after the deleting process is executed once, since the DVD-R 1 is of the write-once type, the start information in the lead-in area LI, file system information in the file system area FS, reproduction control information in the reproduction control information area NV, backup information in the backup area BP, and temporary end information in the border-out area BO remain the same without being changed.

[0054] Although there is no actual change in the recorded information in the recording information area DT, in new reproduction control information (that is, virtual reproduced recording information) is divided into, as shown on the right side of Fig. 1, first recording information stored in a first recording information area DT1, second recording information stored in a second recording information area DT2, and deletion information stored in a deletion information area NG (information which will not be reproduced after the deleting process).

[0055] In addition, after the deleting process, a border-in area BI, a file system area FS2, a reproduction control information area NV2, a backup area BP2, a border-out area BO2, and a empty area EP' are newly formed. A single border area BA is formed by the border-in area BI and the border-out area BO.

[0056] In the reproduction control information area NV2, out of the original recording information recorded in the recording information area DT, reproduction control information for preventing the deleted information stored in the deletion information area NG from being reproduced is recorded. In other words, the reproduction control information to make the information apparently deleted in the reproduction information after the deleting process is recorded.

[0057] In the border-in area BI, start information as control information necessary to start detecting reproduction control information in the reproduction control information area NV2 newly recorded is recorded.

[0058] In the file system area FS2, file system information indicative of a hierarchical structure of the like of new reproduction control information recorded in the reproduction control information area NV2 is recorded.

[0059] In the backup area BP2, in a manner similar to the backup area BP, as backup information used in the case where the reproduction control information recorded in the reproduction control information area NV2 cannot be read, the same reproduction control information is recorded.

[0060] In the border-out area BO2, in a manner similar to the border-out area BO, temporary end information necessary to temporarily finish the recording of the recording information after the deleting process is recorded.

[0061] The area on the DVD-R 1 other than the above-described areas is left as it is as a new empty area EP' in which no information is recorded.

[0062] As described above, in the DVD-R 1, it is necessary to re-record all the reproduction control information for controlling the reproduction mode of the whole recording information subjected to the deleting process including the reproduction control information for deleting a part or all of the original recording information before the deleting process. Consequently, even in the case of performing the deleting process in which no new information is recorded, the remaining capacity EP decreases gradually. The whole recording information denotes the first recording information stored in the first recording information area DT1, the second recording information stored in the second recording information area DT2, and the deletion information stored in the deletion information area NG.

[0063] The amount of the information recorded in each of the areas other than the recording information area DT is predetermined. Specifically, the amount of the start information in the border-in area BI is preset as 192 Kbytes (corresponding to 6 ECC (Error Correcting Code) blocks). The amount of each of the file system information in the file system information areas FS and FS2, the reproduction control information in each of the reproduction control information areas NV and NV2, and the backup information in each of the backup areas BP and BP2 is preset as about 512 Kbytes. As shown in Fig. 2, the amount of the information in the border area BA constructed by the border-in area BI and the border-out area BO is set in six ways in the range from about 6 Mbytes to about 96 Mbytes depending on the position in which the border area BA is formed on the DVD-R 1 and depending whether the border area is formed first or not. The formation position in Fig. 2 is shown by using the position on the DVD-R 1 expressed in hexadecimal notation. The ECC block in the display of an information amount denotes a block as an error correction unit in an error correcting process executed at the time of reproducing the recorded information.

II. Embodiment of Information Recording/Reproducing Apparatus

[0064] The configuration of the information recording/reproducing apparatus according to the embodiment in which a process of recording the information and a process of reproducing the recorded information are execut-

ed will be described by referring to Figs. 3 to 8.

[0065] Fig. 3 is a block diagram showing a schematic configuration of the information recording/reproducing apparatus. Each of Figs. 4 and 5 is a flowchart of the editing process of the embodiment. Each of Figs. 6A and 6B to 8A and 8B is a diagram showing an example of a setup screen or the like displayed in association with the editing process.

[0066] As shown in Fig. 3, an information recording/ reproducing apparatus S according to the embodiment has a pickup 2, a modulator 3, a formatter 4, a video encoder 5, an audio encoder 6, a system controller 7 as a remaining capacity detecting device, a determining device, and a notifying device, a memory 9, a demodulator 10, a video decoder 11, an audio decoder 12, a servo IC (Integrated Circuit) 13, a spindle motor 14, an operation unit 15, a multiplexer 16, a demultiplexer 17, a menu screen generating circuit 18, and a switch 19.

[0067] The system controller 7 has a navigation information generator 8.

[0068] The schematic operation of each of the components will now be described.

[0069] First, an operation of recording video information or audio information input from the outside onto the DVD-R 1 loaded in the information recording/reproducing apparatus S will be described.

[0070] In the recording operation, the spindle motor 14 rotates the DVD-R 1 at preset rotational speed on the basis of a spindle control signal Sss sent from the servo IC 13.

[0071] Video information Sv as recording information to be recorded onto the DVD-R 1 is input from the outside and entered to the video encoder 5.

[0072] The video encoder 5 performs a preset encoding process, to be specific, for example, an MPEG (Moving Picture Experts Group) compression coding process on the video information Sv on the basis of a control signal Scv from the system controller 7 to thereby generate an encoded video signal Sev and outputs the encoded video signal Sev to the multiplexer 11.

[0073] Audio information Sa as recording information to be recorded on the DVD-R 1 is input from the outside and then entered to the audio encoder 6.

[0074] The audio encoder 6 performs a preset encoding process, to be specific, for example, the MPEG compression coding process on the audio information Sa on the basis of a control signal Sca from the system controller 7 to thereby generate an encoded audio signal Sea, and outputs the encoded audio signal Sea to the multiplexer 11.

[0075] The multiplexer 11 multiplexes image information and sound information which is included in the encoded video signal Sev by a preset process to thereby generate a multiplex signal Smx and outputs the multiplex signal Smx to the formatter 4.

[0076] The multiplexer 11 allows the encoded audio signal Sea to pass and to be used as the multiplex signal Smx.

[0077] The formatter 4 combines a navigation information signal Snd (navigation information signal Snd including the reproduction control information) from the navigation information generator 8 which will be described later and the multiplex signal Smx on the basis of a control signal Scf from the system controller 7 to thereby generate a formal signal Smt and outputs the format signal Smt to the modulator 3.

[0078] The recording information supplied as the multiplex signal Smx to the formatter 4 is output as a recording information signal Sfm to the system controller 7 at a preset timing so as to be used to generate the reproduction control information (hereinafter, also properly called navigation information) in the navigation information generator 8.

[0079] The modulator 3 performs a preset modulating process, for example, what is called 8-16 modulating process on the format signal Smt to thereby generate a modulation signal Sfe and outputs the modulation signal Sfe to the pickup 2.

[0080] The pickup 2 generates a light beam B of which intensity is modulated by the modulation signal Sfe, and an information track in an information recording face (not shown) of the DVD-R 1 is irradiated with the light beam B, thereby generating a pit, which corresponds to the navigation information and each of the recording information included in the modulation signal Sfe, on the information track, and recording the navigation information and the recording information in a physical format preset for the DVD-R onto the DVD-R 1. The navigation information includes backup information related to the navigation information, file system information, and temporary end Information.

[0081] A deviation in the direction perpendicular to the information recording face and in the horizontal direction between a condensing position of the light beam B and the information track is solved by moving a not-illustrated objective lens (objective lens for condensing the light beam B) in the pickup 2 in the above-described perpendicular direction and horizontal direction on the basis of a pickup servo signal Ssp outputted from the servo IC 13. That is, focusing servo control and tracking servo control are executed.

[0082] The servo IC 13 generates the spindle control signal Sss and the pickup servo signal Ssp on the basis of a control signal Ssc from the system controller 7 and outputs the spindle control signal Sss and the pickup servo signal Ssp to the spindle motor 14 and the pickup 2, respectively.

[0083] When an operation for executing the recording process in the information recording/reproducing apparatus S is performed by the user, the operation unit 15 generates an operation signal Sin corresponding to the operation and outputs the signal to the system controller 7.

[0084] The navigation information generator 8 generates the navigation information signal Snd including the navigation information to be recorded on the DVD-R 1

under the control of the system controller 7 on the basis of the operation signal Sin and the recording information signal Sfm and outputs the navigation information signal Snd to one of the input terminals of the formatter 4.

[0085] The recording information in the multiplex signal Smx and the navigation information in the navigation information signal Snd are multiplexed by the formatter 4, and the format signal Smt including the recording information in the above-described physical format is generated.

[0086] The operation of reproducing the recording information and the like already recorded on the DVD-R 1 on the basis of the navigation information also recorded will now be described.

[0087] In the reproducing operation, the switch 19 is switched to the video decoder 11 side on the basis of a control signal Scsw from the system controller 19.

[0088] In the reproducing operation, first, the pickup 2 generates the light beam B for reproduction having a predetermined intensity, and the information track on which the pit is formed is irradiated with the light beam B. On the basis of reflection light of the light beam B, a detection signal Spp corresponding to the recording information and navigation information is generated, and outputted to the demodulator 10 and the system controller 7.

[0089] The demodulator 10 performs a demodulating process corresponding to the modulating process in the modulator 3 onto the detection signal Spp to thereby generate a demodulated signal Spd and outputs the demodulated signal Spd to the demultiplexer 17.

[0090] When the demodulate signal Spd includes video information, the demultiplexer 17 demultiplexes the video information into the image information and sound information included in the video information to thereby generate a demultiplex signal Sdmx, and outputs the demultiplex signal Sdmx to the video decoder 11.

[0091] When a demodulated signal Spd includes audio information, the demultiplexer 17 passes the demodulated signal Spd as it is and outputs the signal to the audio decoder 12.

[0092] The video decoder 11 performs a decoding process corresponding to the encoding process by the video encoder 5 onto the demultiplex signal Sdmx on the basis of a control signal Scdv from the system controller 7 to generate a decoded video signal Sdv, and outputs the signal as a video output signal Sdout via the switch 19 to an external monitor (not shown) or the like.

[0093] The audio decoder 12 performs a decoding process corresponding to the encoding process in the audio encoder 6 onto the demodulated signal Spd including the audio information on the basis of a control signal Scda from the system controller 7 to generate a decoded audio signal Sda, and outputs the decode audio signal Sda to an external amplifier (not shown) on the outside of the like.

[0094] The deviation in the direction perpendicular to the information recording face and the horizontal direc-

tion between the condensed position of the light beam B and the information track is solved by the focusing servo control and the tracking servo control based on the pickup servo signal Ssp output from the servo IC 13 in a manner similar to the recording process.

[0095] To reproduce the recording information in a reproduction mode indicated by the navigation information on the basis of the operation signal Sin corresponding to the operation for executing the reproducing process executed in the operation unit 15 and the navigation information included in the detection signal Spp, the system controller 7 generates the control signal Ssc so as to control the irradiation position on the DVD-R 1 of the light beam B for reproduction emitted from the pickup 2, outputs the control signal Ssc to the servo IC 13, generates the control signals Scdv and Scda, and outputs the control signals Scdv and Scda to the video decoder 11 and the audio decoder 12, respectively.

[0096] Consequently, the recording information is reproduced in accordance with the reproduction order, reproduction time, or the like indicated by the navigation information.

[0097] An operation of executing the deleting process of deleting a part of the recording information already recorded on the DVD-R 1 will now be described.

[0098] In the case where the deleting process is executed, the switch 19 is switched to the menu screen generating circuit 18 side on the basis of the control signal Scsw from the system controller 7.

[0099] The menu screen generating circuit 18 generates a menu screen (setup screen) for setting deletion, which will be described later, by using the decoded video signal Sdv on the basis of a control signal Scmu from the system controller 7, and outputs the screen as a screen signal Smu to the not-illustrated monitor or the like via the switch 19.

[0100] After that, when the name of recording information to be deleted according to the menu screen, the deletion range, or the like is input from the operation unit 15, the navigation information generator 8 generates new navigation information having the contents for preventing a part of the recording information to be deleted from being reproduced in a reproducing process after that in correspondence with information input from the operation unit 15, generates the navigation information signal Snd including the navigation information, and records the new navigation information, backup information related to the navigation information, file system information, temporary end information, and the like in the empty area of the DVD-R 1 via the formatter 4, modulator 3, and pickup 2.

[0101] In parallel with the operations, while transmitting/receiving necessary information as a memory signal Sm to/from the memory 9, the system controller 7 generates the control signals Scv, Sca, Scf, Ssc, Scdv, Scsw, Scmu, and Scda for controlling the operations and outputs the control signals to the corresponding component members.

[0102] The detailed operation of executing the editing process as the above-described deleting process will be described by referring to Fig. 1 and Figs. 4 to 8.

[0103] As shown in Fig. 4, in the editing process, first, the focusing servo control on the light beam B is turned on under the control of the servo IC 13 (step S1).

[0104] In a state where the focusing servo control is ON, on the basis of reflection light of the light beam B, whether a wobble occurs in an information track or not on the optical disk loaded in the information recording/ reproducing apparatus S at present is detected (step S2).

[0105] Generally, the information track in a reproduction only DVD does not wobble. On the other hand, in a DVD-R (DVD-recordable) and DVD-RW (DVD-Re-Recordable; DVD on which information can be recorded plural times), the information track wobbles so that a clock signal as a reference at the time of recording is extracted or the like.

[0106] In determination of step S2, when no wobble on the information track is detected (step S2; NO), while executing phase difference method tracking servo control adapted to an information track which is not wobbling, the lead-in area of the loaded optical disk is irradiated with the light beam B (step S3). On the basis of the information obtained from the area, the type of the optical disk is determined. Specifically, whether the optical disk is the play-only DVD, DVD-R, or DVD-RW is determined (steps S4 and S5).

[0107] When it is determined in step S5 that the loaded optical disk is a play-only DVD, that is, either a DVD-ROM (DVD-Read Only Memory) on which data information for a computer or the like is recorded or a play-only DVD on which a movie or the like is recorded (step S5; YES), a flag indicating that the optical disk is a play-only DVD is set in the system controller 7 (step S6), the apparatus enters a standby mode.

[0108] On the other hand, when it is determined in step S5 that the loaded optical disk is not a play-only DVD (step S5; NO), since the state in which the information track is not wobbling (step S2; NO) and the type of the optical disk is not the play-only DVD (step S5; NO) is impossible, a warning of occurrence of an abnormal state such that a deformed optical disk or an optical disk which has a large blemish and cannot be reproduced is loaded is given to the user (step S7). The optical disk is ejected to the outside of the information recording/reproducing apparatus S (step S8) and the apparatus enters a standby mode.

[0109] When it is determined in step S2 that a wobble is detected on the information track (step S2; YES), while executing a push-pull tracking servo control adapted to the wobbling information track, the lead-in area of the loaded optical disk is irradiated with the light beam B (step S9), and the type of the optical disk is determined on the basis of information obtained from the area (steps S10 and S11).

[0110] When it is determined in step S11 that the load-

ed optical disk is the DVD-R 1 (step S11; YES), a flag indicating that the optical disk is the DVD-R 1 is set in the system controller 7 (step S12), and the apparatus enters a standby mode.

[0111] When it is determined in step S11 that the loaded optical disk is not the DVD-R 1 (step S11; NO), whether the optical disk is the DVD-RW or not is determined (step S13). When the loaded optical disk is the DVD-RW (step S13; YES), a flag in the system controller 7 indicating that the optical disk is the DVD-RW is set (step S14), and the apparatus enters the standby mode.

[0112] When it is determined in step S13 that the loaded optical disk is not the DVD-RW (step S13; NO), since the state in which the information track is wobbling (step S2; YES) and the type of the optical disk is not the DVD-R 1 or the DVD-RW (step S13; NO) is impossible, a warning that the abnormal state is detected is given to the user (step S7). The optical disk is ejected to the outside of the information recording/reproducing apparatus S (step S8) and the apparatus enters a standby mode.

[0113] The details of an actual editing process executed after the type determining process or the like shown in Fig. 4 is executed and the apparatus enters the standby mode will be described by referring to Fig. 5.

[0114] In the editing process, first, whether an instruction of executing the editing process is executed in the operation unit 15 or not is determined (step S20). If the editing process is not executed (step S20; NO), the process is finished. If the editing process is executed (step S20; YES), whether the optical disk loaded in the information recording/reproducing apparatus S at present is the DVD-R 1 or not is determined by referring to the flag in the system controller 7 (step S21).

[0115] When the optical disk is not the DVD-R 1 (step S21; NO), it is determined that the optical disk is an editable DVD except for the DVD-R 1, that is, the DVD-RW. An edit menu for the DVD-RW is generated by the menu generating circuit 18 and displayed on the monitor (not shown) or the like (step S32).

[0116] Fig. 6A shows an example of the edit menu displayed on the monitor or the like. The edit menu M includes a title TT of the edit menu, a button BI to be operated to change the name of the currently loaded DVD-RW itself, a button B2 to be operated to edit each recording information (hereinafter, the recording information is called a title) recorded in the DVD-RW, a button B3 operated at the time of erasing all the titles recorded in the DVD-RW, an end button ED operated at the time of finishing the editing process, and a decision button CM operated to determine (execute) the operated process.

[0117] After the edit menu M is displayed an actual editing process using the edit menu M is executed (step S33), and whether the operation of finishing the editing process is executed by the operation unit 15 or not is determined (step S34).

[0118] When the editing process is not finished (step

S34; NO), the processing of the embodiment returns to step S33 and the editing process is continued. On the other hand, when the operation of finishing the editing process is performed (step S34; YES), a process of rewriting the contents of the DVD-RW with the edited recording information and the navigation information (including corresponding file system information) corresponding to the recording information is executed (step S35), and the process is finished.

[0119] When it is determined in step S21 that the optical disk loaded in the information recording/reproducing apparatus S is the DVD-R 1 (step S21; YES), the amount of information in the current empty area (refer to the reference characters EP in Fig. 1) in the DVD-R 1 is calculated on the basis of the file system information recorded in the DVD-R 1 and the like (step S22) and, further, whether the value of the calculated information amount is equal to or larger than a preset minimum value or not is determined (step S23).

[0120] The minimum value in step S23 is equal to a total value of new navigation information (512 Kbytes), file system information (512 Kbytes), backup information (512 Kbytes), temporary end information and start information to be recorded in the border-in area BI (6 to 96 Mbytes as a total of the temporary end information and the start information) generated by the editing process of once and to be added. That is, the minimum value is changing from about 7.5 Mbytes to about 97.5 Mbytes depending on the formation position of the border area BA and depending on whether the border area BA is formed for the first time. When a empty area EP less than the minimum value remains in the DVD-R 1, the minimum value denotes an information amount of the empty area in which the editing process cannot be performed in the DVD-R 1.

[0121] When it is determined in step S23 that the information amount of the empty area EP is equal to or larger than the minimum value (step S23; YES), the editing process of once or more can be performed, so that the specific number of times the editing process can be performed is calculated (step S25).

[0122] The number of times the editing process can be performed is calculated in step S25 by dividing the information amount of the empty area EP calculated in step S22 by the minimum value (about 7.5 Mbytes to 97.5 Mbytes) while considering the formation position of the border area BA.

[0123] After calculating the specific number of times the editing process can be performed, the edit menu for the DVD-R 1 including the calculated number of times the editing process can be performed is generated by the menu generating circuit 18 and displayed on the not-illustrated monitor or the like (step S26).

[0124] As the edit menu displayed on the monitor or the like, for example as shown in Fig. 6B, an edit menu MN including not only the configuration of the edit menu M shown in Fig. 6A but also the number of times CP the editing process can be performed indicative of the

number of times the editing process can be performed calculated in step S25 is displayed.

[0125] After the edit menu MN is displayed, the editing process according to the edit menu MN is executed (step S27). By the editing process, the corresponding new start information, file system information, navigation information, backup information, and temporary end information are generated and temporarily stored in a not-illustrated memory in the system controller 7.

[0126] The concrete flow of the editing process in step S27 in the case where the button B2 is operated in the edit menu MN displayed in step S26 will be described as an example. First, a corresponding individual edit screen MD as shown in Fig. 7A is generated by the menu generating circuit 18 and displayed.

[0127] The individual edit screen MD includes a title TT, the number of times CP the editing process can be performed, representative image displays SM1 to SM6 (in the case where the total number of the titles is "6") displaying representative images (what is called thumbnail images) each having the title recorded in the DVD-R 1 at present, selection number indication NB in which the number of the selected title is displayed, the end button ED operated to finish the title selection, and the decision button CM operated to finally determine the title selection.

[0128] For example, when the title 1 is selected on the individual edit screen MD (refer to Fig. 7A), an edit menu MM indicative of the contents of the individual editing process is generated by the menu generating circuit 18 and displayed.

[0129] In this case, as shown in Fig. 7B, the edit menu MM includes the title TT, the number of times CP the editing process can be performed, a button B4 operated to disable a future editing process of the selected title, a button B5 operated to change the name of the selected title, a button B6 operated to delete (erase) the selected title from the DVD-R 1 (that is, to disable reproduction), a button B7 operated to delete a part in the selected title (in the case shown in Fig. 7B, a portion from the point A (start point) to the point B (end point) in the selected title), the end button ED operated to finish the editing process, and the decision button CM operated to finally determine the contents of the editing process.

[0130] The decision button CM in the edit menu MM is operated to determine whether the editing process is finished or not (step S28). When the decision button CM is not operated (step S28; NO), the editing process is continuously executed. Consequently, the processing of the embodiment returns to the step S26. On the other hand, when the decision button CM is operated (step S28; YES), to confirm whether the editing process is finally executed or not (in other words, whether new navigation information or the like is generated and additionally recorded on the DVD-R 1 or not), an editing process execution confirmation screen MR as shown in Fig. 8A is generated by the menu generating circuit 18 and displayed (step S29).

[0131] The execution confirmation screen MR includes the title TT, confirmation indication W for confirming deletion of the selected title and indicating the number of times the editing process can be performed after that, a representative image display SM for displaying a representative image of the title to be deleted, a cancellation button CL operated to cancel the editing process, and a confirmation button CO operated to execute the editing process.

[0132] When the execution confirmation screen MR is displayed, whether the confirmation button CO in the execution confirmation screen MR is operated or not is determined (step S30). When the confirmation button CO is not operated (step S30; NO), the processing of the embodiment returns to step S26 to execute the editing process again. On the other hand, when the confirmation button CO is operated (step S30; YES), to execute the editing process, the start information in the border-in area BI, file system information, navigation information, backup information, and temporary end information which are generated and stored in step S27 as a result of the editing process is read and recorded to the empty area. For example, as shown in the right side of Fig. 1, the border-in area BI, file system area FS2, reproduction control information area NV2, backup area BP2, and border-out area BO2 are generated (step S31), and the series of editing processes is finished.

[0133] When it is determined in step S23 that the information amount of the empty area EP is less than the minimum value (step S23; NO), the editing process cannot be performed even once. Consequently, a warning screen MW as shown in Fig. 8B is generated by the menu generating circuit 18 and displayed on the not-illustrated monitor or the like (step S24), and the process is finished.

[0134] The warning screen MW includes the title TT, warning indication WN indicating that the editing process cannot be performed due to an insufficient information amount in the empty area EP, and a confirmation button CO operated when the user understands the warning indication WN.

[0135] By the display of the warning screen MW, the user recognizes that the editing process cannot be executed even if it is the deleting process due to an insufficient information amount of the empty area EP of the DVD-R 1.

[0136] As described above, according to the editing process in the information recording/reproducing apparatus S of the embodiment, whether the editing process can be performed on the information recorded on the DVD-R 1 or not is displayed. Thus, the user can recognize the state before actually executing the editing process.

[0137] As the number of times the editing process can be performed on the recording information is determined and the determined number is displayed, the user can recognize the specific number of times the editing process can be performed before actually executing the

editing process.

[0138] Further, since the editing process is to delete all or a part of the information recorded on the DVD-R 1, prior to execution of deleting a part or all of the recorded information, whether the information can be deleted or not can be recognized.

III. Modifications of Information Recording/Reproducing Apparatus

[0139] Modifications according to the invention will now be described by referring to Figs. 9 and 10.

[0140] Each of Figs. 9 and 10 is a flowchart showing the editing process of each of modifications. The same processes as those in the flowchart showing the editing process of the embodiment shown in Fig. 5 are designated by the same step numbers and the details will not be described.

[0141] First, the first modification will be described by referring to Fig. 9.

[0142] In the foregoing embodiment, the number of editing processes which can be performed after that is displayed to allow the user to confirm it (refer to step S25 in Fig. 5) and, after that, the actual editing process is executed (steps S26 to S31 in Fig. 5). Alternately, it is also possible to execute the editing process first and display the number of editing processes which can be performed immediately before recording new navigation information or the like to the DVD-R 1.

[0143] Specifically, as shown in Fig. 9, as the editing process of the first modification, first, the editing process is started (step S20; YES). The actual editing process using a not-illustrated memory in the system controller 7 is performed first (steps S26 to S28), and the type of the optical disk loaded in the information recording/reproducing apparatus S is determined (step S21).

[0144] When the type of the optical disk is the DVD-RW (step S21; NO), a rewrite editing process adapted to the DVD-RW is executed (step S35), and the process is finished.

[0145] When the optical disk is the DVD-R 1 (step S21; YES), the information amount of the empty area EP is calculated (step S22) and is compared with the minimum value (step S23).

[0146] The information amount of the empty area EP is less than the minimum value (step S23; NO), the warning screen MW (refer to Fig. 8B) is displayed (step S24), and the process is finished.

[0147] When the information amount of the empty area EP is equal to or larger than the minimum value (step S23; YES), the actual number of times the editing processes can be performed is calculated (step S25) and the execution confirmation screen MR (refer to Fig. 8A) is displayed (step S29). If the execution is confirmed (step S30; YES), the new navigation information or the like is recorded on the DVD-R 1 (step S31), and the process is finished.

[0148] By the editing process of the first modification

as well, an effect similar to that of the foregoing embodiment can be produced.

[0149] A second modification will now be described by referring to Fig. 10.

[0150] The second modification described hereinafter is similar to the first modification with respect to the point that the editing process is executed first, and the number of times the editing process can be performed is displayed before the new navigation information or the like is recorded on the DVD-R 1 but is different from the first modification that the information amount is not compared with the minimum value.

[0151] As shown in Fig. 10, the editing process of the second modification is performed as follows. First, the editing process is started (step S20; YES), the actual editing process using the not-illustrated memory of the system controller 7 is performed first (steps S26 to S28), and the type of the optical disk loaded in the information recording/reproducing apparatus S is determined (step S21).

[0152] When the type of the optical disk is the DVD-RW (step S21; NO), a rewrite editing process adapted to the DVD-RW is executed (step S35), and the process is finished.

[0153] When the optical disk is the DVD-R 1 (step S21; YES), the information amount of the empty area EP is calculated (step S22), the actual number of times the editing process can be performed is calculated on the basis of the calculated information amount (step S25), and whether the number of times is equal to "0" or not is determined (step S40).

[0154] When the number of times is "0" (step S40; YES), the warning screen MW (refer to Fig. 8B) is displayed (step S24), and the process is finished.

[0155] When the number of times is not "0" (step S40; NO), the execution confirmation screen MR (refer to Fig. 8A) is displayed (step S29). When the execution is confirmed (step S30; YES), the new navigation information or the like is recorded on the DVD-R 1 (step S31), and the process is finished.

[0156] With respect to the execution confirmation screen MR displayed in step S29, the number of times the editing process can be performed calculated as shown in Fig. 8A (refer to step S25) may be displayed or may not be displayed.

[0157] In the editing process according to the second modification, an effect similar to the foregoing embodiment can be produced. In addition, not only the number of times the editing process can be performed but also whether the process of editing the recorded information can be performed or not can be determined and the result of determination is notified. Thus, before the execution of the actual editing process, the user can recognize whether the editing process can be performed or not.

[0158] In the foregoing embodiment and modifications, the message that the editing process cannot be performed is notified by displaying the warning screen MW on the not-illustrated monitor or the like. It is also

possible to notify the message by, for example, sound.

[0159] In the foregoing embodiment and modifications, the case where the editing process is executed on information recorded on the DVD-R 1 has been described. The invention can be also applied to a process of deleting information recorded on a CD-R (CD-Recordable) as another write-once recording medium.

[0160] Further, in the foregoing embodiment and modifications, at the time of executing the editing process, all of the file system information, navigation information, and backup information (all the information including changed information and information which does not have to be changed) is additionally recorded. It is also possible to additionally record only a changed portion when the information is compared with the file system information, navigation information, and backup information before edit, as new file system information, navigation information, and backup information.

[0161] Further, it is also possible to record the program corresponding to the flowchart shown in Fig. 4, 5, 9, or 10 on an information recording medium such as a flexible disk or hard disk, and read and execute the recorded program by a personal computer or a general CPU. In such a manner, the personal computer or the general CPU can function as the system controller 7.

[0162] The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the forgoing description and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraces therein.

Claims

1. An information editing apparatus (S) for editing recording information already recorded on a recording medium (1) on which information can be recorded only once, **characterized in that** the apparatus comprises:

   a remaining capacity detecting device (7) for detecting a remaining capacity as a recording capacity of an unrecorded area on said recording medium;
   a determining device (7) for determining whether said recording information can be edited or not on the basis of said detected remaining capacity and an amount of information to be recorded in said unrecorded area by editing said recording information; and
   a notifying device (7) for notifying a result of said determination.

2. The information editing apparatus (S) according to

claim 1, wherein said determining device (7) determines the number of times said recording information can be edited after said determination, and

     said notifying device (7) notifies said determined number of times.

3. The information editing apparatus (S) according to claim 1, wherein said determining device (7) determines whether said recording information can be edited or not after said determination, and

     said notifying device (7) notifies whether said recording information can be edited or not.

4. The information editing apparatus (S) according to any one of claims 1 to 3, wherein editing of said recording information is deletion of all or a part of said recording information recorded on said recording medium.

5. The information editing apparatus (S) according to claim 4, wherein said information to be recorded in said unrecorded area including reproduction control information for preventing said deleted recording information from being reproduced.

6. An information editing method of editing recording information already recorded on a recording medium on which information can be recorded only once, **characterized in that** the method comprises:

     a remaining capacity detecting process of detecting a remaining capacity as a recording capacity of an unrecorded area on said recording medium (1);
     a determining process of determining whether said recording information can be edited or not on the basis of said detected remaining capacity and an amount of information to be recorded in said unrecorded area by editing said recording information; and
     a notifying process of notifying a result of said determination.

7. The information editing method according to claim 6, wherein the number of times said recording information can be edited after said determination is determined in said determining process, and
     said determined number of times is notified in said notifying process.

8. The information editing method according to claim 6, wherein whether said recording information can be edited or not is determined after said determination in said determining process, and
     whether said recording information can be edited or not is notified in said notifying process.

9. The information editing method according to any

one of claims 6 to 8, wherein editing of said recording information is deletion of all or a part of said recording information recorded on said recording medium (1).

10. The information editing method according to claim 9, wherein said information to be recorded in said unrecorded area including reproduction control information for preventing said deleted recording information from being reproduced.

11. An information recording medium on which a program for controlling an edit is recorded so as to be read by an editing computer included in an information editing apparatus (S) of editing recording information already recorded on a recording medium on which information can be recorded only once, **characterized in that** said program causes said editing computer to function as:

     a remaining capacity detecting device (7) for detecting a remaining capacity as a recording capacity of an unrecorded area on said recording medium;
     a determining device (7) for determining whether said recording information can be edited or not on the basis of said detected remaining capacity and an amount of information to be recorded in said unrecorded area by editing said recording information; and
     a notifying device for notifying a result of said determination.

12. The information recording medium according to claim 11, wherein said determining device (7) determines the number of times said recording information can be edited after said determination, and
     said notifying device (7) notifies said determined number of times.

13. The information recording medium according to claim 11, wherein said determining device (7) determines whether said recording information can be edited or not after said determination, and
     said notifying device (7) notifies whether said recording information can be edited or not.

14. The information recording medium according to any one of claims 11 to 13, wherein editing of said recording information is deletion of all or a part of said recording information recorded on said recording medium (1).

15. The information editing method according to claim 14, wherein said information to be recorded in said unrecorded area including reproduction control information for preventing said deleted recording information from being reproduced.

FIG. 1

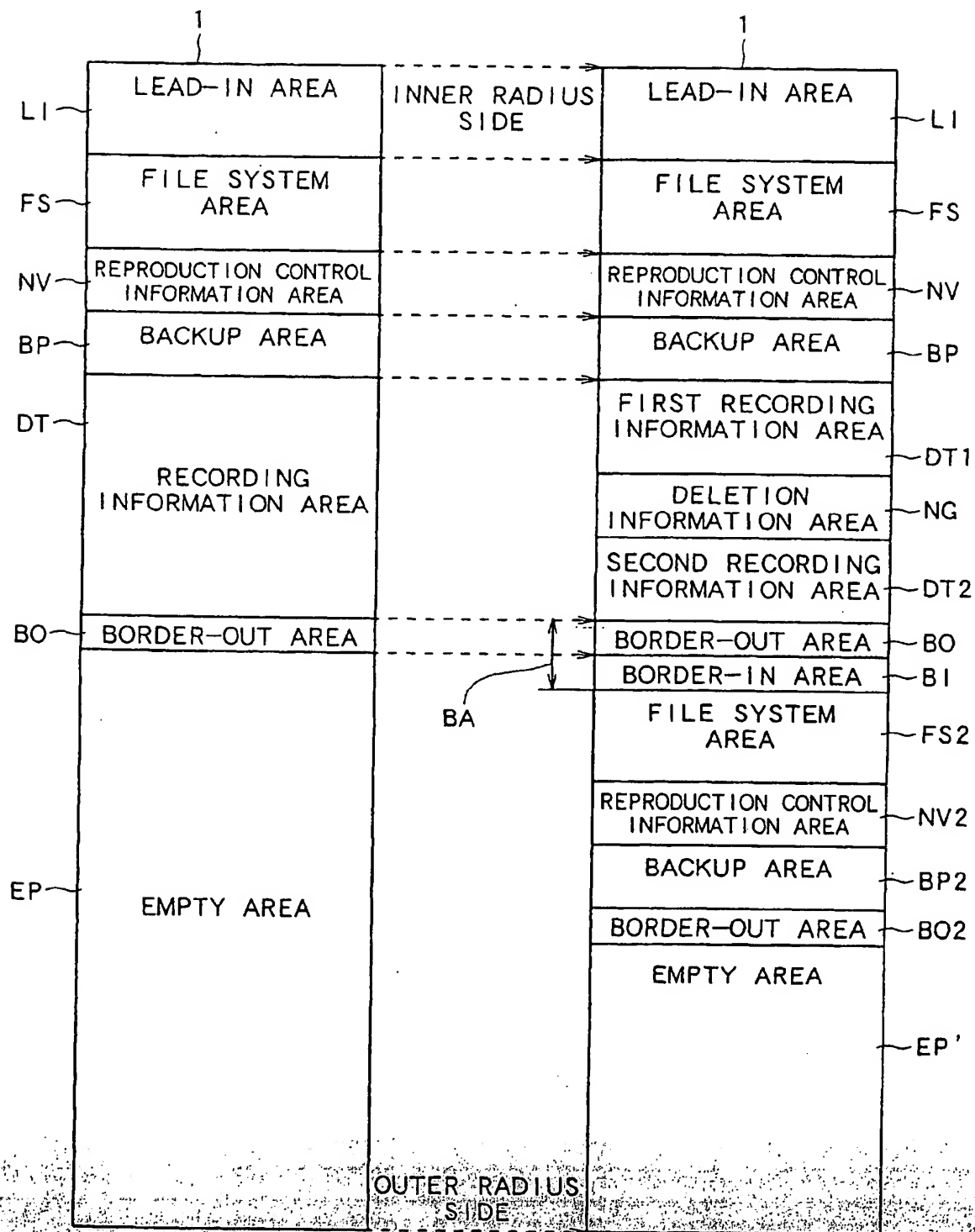|		
LI~	LEAD-IN AREA	INNER RADIUS SIDE
FS~	FILE SYSTEM AREA	
NV~	REPRODUCTION CONTROL INFORMATION AREA	
BP~	BACKUP AREA	
DT~	RECORDING INFORMATION AREA	
BO~	BORDER-OUT AREA	
EP~	EMPTY AREA	

Right side:

LEAD-IN AREA	~LI
FILE SYSTEM AREA	~FS
REPRODUCTION CONTROL INFORMATION AREA	~NV
BACKUP AREA	~BP
FIRST RECORDING INFORMATION AREA	~DT1
DELETION INFORMATION AREA	~NG
SECOND RECORDING INFORMATION AREA	~DT2
BORDER-OUT AREA	~BO
BORDER-IN AREA	~BI
FILE SYSTEM AREA	~FS2
REPRODUCTION CONTROL INFORMATION AREA	~NV2
BACKUP AREA	~BP2
BORDER-OUT AREA	~BO2
EMPTY AREA	
	~EP'

BA

OUTER RADIUS SIDE

13

NSDOCID: <EP_____1182661A2_I_>

FIG. 2

FORMATION POSITION OF BORDER AREA	CAPACITY OF FIRST BORDER AREA	CAPACITY OF ANOTHER BORDER AREA
3D700h~ 9DAFFh	32 MBYTES (1024 ECC BLOCKS)	6 MBYTES (192 ECC BLOCKS)
9DB00h~ 1342FFh	64 MBYTES (2048 ECC BLOCKS)	12 MBYTES (384 ECC BLOCKS)
134300h~	96 MBYTES (3072 ECC BLOCKS)	18 MBYTES (576 ECC BLOCKS)